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Francis Kirby M.A. M.D.
for exchange

PHARMACOLOGIA,

BEING

AN EXTENDED INQUIRY

INTO

THE OPERATIONS OF MEDICINAL BODIES,

UPON WHICH ARE FOUNDED

THE

THEORY AND ART OF PRESCRIBING.

BY

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EDITION THE NINTH.

REWRITTEN IN ORDER TO INCORPORATE THE LATEST DISCOVERIES IN PHYSIOLOGY, CHEMISTRY, AND MATERIA MEDICA.

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TO

SIR BENJAMIN BRODIE, BART., F.R.S.

SERJEANT SURGEON TO HER MAJESTY,

&c. &c,

My dear Sir Benjamin,

If the expression of private regard could add point to a dedication, which derives its propriety from considerations of a public nature; or were it necessary to justify the selection of a name, honourably stamped as it is by the unanimous consent of our profession, I might well appeal to a friendship of years, and gratefully refer to that consummate skill, through which am now living to acknowledge it; or I might recall the memory of our common friend, Dr. Maton, and plead all its cherished associations, as a personal motive for replacing his name by that of one who so long possessed his confidence, and enjoyed his friendship; but you stand here recorded on a far loftier ground—you are selected as the representative of a class of philosophers who, by original research and skilful induction, have extended the boundaries of science, and applied its principles to the advancement of the healing art. Your papers in the Philosophical Transactions are justly regarded as having given a fresh impulse, and a novel direction,

to a very important train of research, and to which many of the propositions contained in the following work may be said to have an intimate relation: while your work on Calculous Diseases has enriched the profession with improved methods of cure, and given a value to the chapter on Antilithic Remedies, without which it would have possessed but slender claims to practical utility.

That you may long live to enjoy a reputation which is the noblest reward of talents usefully directed, and that the public may, for years to come, continue to derive comfort and alleviation from the active exercise of them, is the humble prayer and fervent hope of

Your grateful friend,

JOHN AYRTON PARIS.

Dover Street,
January, 1843.

PREFACE.

When this work first appeared, in the year 1812, the public were in possession of several "Pharmaceutical Epitomes," "Compendiums," and "Vade-mecums," of creditable pretensions, compiled with the avowed objects of directing the practice of the junior, and of refreshing the memory of the more advanced practitioner. They furnished numerous prescriptions, and gave general directions with regard to the doses and effects of particular medicines; and they were thus well enough adapted to relieve an occasional embarrassment, but they did not even attempt to point out the principles upon which a medicinal formula should be constructed, much less did they explain the part which each ingredient might be supposed to perform, in its general arrangement. There were, moreover, several standard works on Materia Medica, and approved systems of Pharmaceutic Chemistry; each of which imparted all the information which the science of the day could afford, with respect to the natural history, sensible qualities, chemical composition, and medicinal virtues of the several articles of the Materia Medica, as well as giving clear explanations of the various pharmaceutical operations, by which such bodies might be rendered available as remedies; but here ended their in-

structions. They placed remedies in the hands of the pupil, but where was the work that would teach him to mix, combine, and direct their application in the form of an extemporaneous prescription?—where was the friendly Mentor to point out to the young practitioner the difficulties and dangers of his path? Amidst all the perplexities of his noviciate, there is none more embarrassing than that of adapting a prescription to all the circumstances of a particular case, with therapeutical propriety and chemical accuracy. On entering his career of practice, he is necessarily abandoned to the alternative of two great evils—a servile routine on the one hand, and a lawless empiricism on the other. It was the want of such assistance to steer my way amidst shoals and rocks that, more than thirty years since, first suggested the plan of the present work.

As years have rolled on, the works of my younger days have been succeeded by others which have kept pace with the successive discoveries of science, the increasing range of experience, and with those corrections of theory, and refinements of nomenclature, which must be ever progressive with the advancement of knowledge. We may now be said to possess works, whose authors have collected the scattered rays which emanate from every department of the sciences, in order to illuminate the objects of their study. The Materia Medica of Pereira, and the Dispensatory of Christison, lie on the table of every intelligent practitioner without a rival; so complete and accurate do I consider their "Special Pharmacology," that I shall for the future abstain from republishing the second part of my work, which through eight editions has been devoted to its investigation; and for this omission, I offer the compensation of a much more extended view of that province, which I

must continue to regard as peculiarly my own, for no author, of the least repute, has hitherto invaded it—THE PHILOSOPHY OF MEDICINAL COMBINATION—from which alone can be deduced the THEORY AND ART OF PRESCRIBING. In the preface to my former editions, I observed that the authors of works professing to guide the novice in his art, had not escaped the too common error of supposing "that the disciple was already grounded in first principles," and that "*while they were in the ship of science, they had forgotten he could not arrive without a boat.*" This observation still remains in full force, and will explain my reasons for occasionally dwelling upon minutiæ which might otherwise appear trifling and unnecessary; but while I am thus most anxious "to catch the ideas which lead from ignorance to knowledge," it is not without a hope that I may also be able to suggest the means by which our acquired knowledge may be more widely and usefully extended; or, to follow up my figurative illustration, "*to furnish a boat which may not only convey the disciple to the ship, but which may also assist in piloting the ship herself from her shallow and treacherous moorings.*"

The Title-page announces that the work has been re-written; this is true to the very letter; its fundamental doctrines have not been shaken, but so rapid and extraordinary has been the advancement of every branch of science during the last ten years, that its very language had become obsolete—a new Pharmacopœia had appeared during this interval, enriched with newly-discovered substances and novel preparations, and with a nomenclature radically changed. The science of chemistry had also, by the aid of quantitative analysis, assumed a new aspect; so that it was impossible, without remodelling the whole work, to render it consistent with the science of the day. Amidst the later discoveries, those of

Liebig will necessarily attract notice, several of which, published in his *Agricultural* work, have furnished me with facts of interesting application; at the same time, it is due to myself, as well as to my readers, to state, that nearly the whole of my work had been printed before I received a copy of his "*Animal Chemistry*," which will explain my silence regarding several of those theories that bear directly against opinions which I have confidently maintained; and are more especially in opposition to those relating to the process of digestion. Liebig, captivated with his theory of transformation, enlists it at once into his service to explain the phenomena of this process. He denies the existence of any distinct digestive principle, and maintains that the change which the food undergoes in the stomach is the result of induction, from the stomach itself yielding a substance in the state of transformation, with which it comes in contact; all experiment is opposed to this view; Schwann actually proved that the principle of the gastric solvent could be precipitated by *acetate of lead* from its neutral solution, and again recovered from the precipitate, with all its former activity, by hydro-sulphuric acid. In addition to which evidence, the observations of Dr. Beaumont, as related at page 262, appear to me to be decisive.

Those only who have watched with parental anxiety the progress of a favourite work through numerous editions, can duly appreciate the feelings of the author, who, after a long interval, is called upon to revise, or remodel it. If, like the one before me, science has been profusely pouring forth her treasures to enrich the subjects upon which it treats, they are, to speak in the language of Priestley, "the most exquisite that can be imagined, since an object in which we see a perpetual progress and improvement is, as it were, continually rising in

its magnitude; and, moreover, when we see an actual increase, in a long period of time past, we cannot help forming an idea of an unlimited increase in futurity;" but such pleasure comes not without its alloy, Time is sure to work his bitter commission; during the last few years, how many friends, identified in my own mind with the progress and success of this work, have sunk into the grave! My respected friend and publisher, William Phillips, has payed the debt of nature, and the tomb has closed over that accomplished naturalist and distinguished physician, by whose friendship I was honoured from a very early period of life, and whose name graced the page of this work for more than a quarter of a century. *Salve et vale.*

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PART I.

REVOLUTIONARY HISTORY

OF

THE MATERIA MEDICA.

REVOLUTIONARY HISTORY

OF

THE MATERIA MEDICA.

To the medical philosopher there exist but few objects of deeper interest than an extensive and well-arranged cabinet of Materia Medica.* What lessons of practical wisdom lie stored within its narrow recesses! How many reminiscences may the contemplation of it call forth, and how many beacons for future guidance may it not afford! Its records are the symbols of medical history—the accredited registers of departed systems, founded on ideal assumptions, and of superstitions engendered by fear and nurtured by ignorance. In its earlier specimens, as from a collection of antique medals, we read the revolutions of the past, and in the space of a few minutes recall the exploded theories of as many centuries, for to these archives have the various sects, which from time to time have held dominion, bequeathed some striking memorial, or left some characteristic trace of their vain and transient existence. With no less interest than instruction will the young practitioner, entering upon his professional career, regard such a collection.

* The College of Physicians possesses a very complete cabinet. That collected by Dr. Burgess, and presented to the College after his death by Mr. Brande, to whom it had been bequeathed, has been collated with that of Dr. Coombe, purchased for that purpose.

In casting his eyes over so extensive and motley an assemblage of substances, he will be forcibly impressed with the palpable absurdity of some—the disgusting and loathsome nature of others—the total inactivity of many—and the uncertain and precarious reputation of all; and he will be naturally impelled by an eager and laudable curiosity to inquire, how it can have happened that substances, at one period in the highest esteem, and of generally acknowledged utility, should have ever fallen into total neglect or disrepute?—why others, of humble pretensions and little significance, should have maintained their ground for so many centuries; and by what caprice or accident, materials of no energy whatever should have continued to receive the indisputable sanction and unqualified support of the best and wisest practitioners of the age; and, above all, he will inquire, by what necromantic spell certain medicinal substances, after having run their appointed course of trial, and been fairly denounced as inert or useless, could ever again have been raised into especial favour, as if but to sink once more into deeper and more lasting discredit?

That such fluctuations in opinion, and versatility in practice, should have produced in the most candid minds an unfavourable impression and misgiving with regard to the reputed efficacy of medicine, can scarcely excite our surprise, and much less justify our indignation. Nor ought we to feel astonished that a less intelligent portion of mankind, or such as are incapable of deep inquiry, should at once have been led to arraign physic as a fallacious art, or to deride it as a tissue of craft and delusion.* They ask, and it must be confessed that they ask with reason, what pledge can be given that the boasted remedies of the present day will not, like their predecessors, fall into disre-

* A late foreign writer, impressed with this sentiment, has given the following flattering definition of our profession. "Physic is the art of amusing the patient, while Nature cures the disease." This is a sarcasm which can only be equalled by the churlish and ill-humoured apostrophe of our own Dr. Samuel Johnson, who, in speaking of the profession of physic, exclaims, "It is a melancholy attendance on misery: a mean submission to peevishness; and a continual interruption of pleasure."

pute, and in their turn serve only as humiliating memorials of the credulity and infatuation of those who may have commended their virtues, or directed their application. There is surely no question connected with the present work more interesting or important, for it assails us upon the very threshold of the porch; nor can there be one which requires a more cool and dispassionate inquiry, for it is surrounded by fallacies, and obscured by discrepant testimony; and there is certainly not any which can present so many points of instruction, for it is thus that we read the lessons of experience, and render the errors of the past the means of improving the future. I therefore propose to take a rapid and sweeping sketch of the different moral and physical causes which have operated in swaying the opinions of the practitioner, and in producing those revolutions which have taken place in the belief of mankind with regard to the power and efficacy of different medicinal substances; and I confidently hope that I may thus be enabled to remove many unjust prejudices, to quiet the doubts and alarms which have been so industriously propagated, and at the same time, by exposing the secret haunts of fallacy, to obviate the recurrence of error, and to diminish the chances of future disappointment.

This moral view of events, without any regard to historical details, or chronological minutiæ, may be denominated the Philosophy of History, and should be carefully distinguished from that technical and barren erudition which consists in little else than a dry record of names and dates; the one expands and trains the reasoning faculties to sound reflection, while the other is perused by the medical student with about as much interest, and perhaps as little profit, as the monk counts his bead-roll.

It has been very justly observed, that there is a certain maturity of the human mind, acquired from generation to generation, *in the mass*, as there is in the different stages of life in the *individual* man: what is history, when thus philosophi-

cally studied, but the faithful record of this progress; pointing out for instruction the various causes which have accelerated, retarded, or obstructed it, in different ages and countries? Thus is our art, in its earlier periods, like the young and sanguine practitioner, characterised by an excess of credulity—every object is tinted with imaginative hues, and magnified in the mist of the dawn; we find, for instance, the early herbals assigning almost incredulous virtues to every herb of the field, while in the present day the list of those which are admitted to possess any real efficacy is reduced to the limit of a few slender pages. Just so is it with the career of the individual. "When I was young," said Dr. Radcliffe, "I possessed at least twenty remedies for every disease, but when advanced in age I found twenty diseases without a single remedy;" or, in other words—for we must not suffer a striking antithesis, by seducing the ear, to mislead the judgment—his imagination had been tempered by reason, and his early credulity subdued by long experience. The mirror of history casts its lights as well as its shadows. It discovers fallacies that may mortify our untaught conceit, but it as surely displays truths which must gratify our pride, inspire our hopes, and give a keener edge to our exertions.

Historians have ever been ambitious of tracing back their subjects to the most remote antiquity, and medical writers have not manifested less eagerness to discover the origin of their art; but in every attempt to thread the stream to its source, we are soon lost in the wilds of conjecture, or in the regions of fable; indeed, it is very unlikely that we should be able, by the most indefatigable research, to approach the period when remedies were first applied for the alleviation of bodily suffering, or to discover any country, however uncivilized, in which its native inhabitants are destitute of medical resources. Amidst the most savage tribes of Africa, New Holland, New Zealand, Lapland, and North America, some rude indications of the arts of medicine and surgery have ever been discovered. The painful feelings of the sufferer, and the

anxiety of those about him, must, in the most barbarous state, have incited a spirit of inquiry and trial to procure relief;* and when ordinary expedients† failed, charms,‡ amulets, and incantations would be the natural resources of the barbarian, who is ever inclined to indulge in the mysteries of superstition. Traces of amulets may be discovered in the earliest history. The learned Dr. Warburton is evidently mistaken when he assigns the origin of these magical instruments to the age of the Ptolemies, which was not more than three hundred years before Christ; this is at once refuted by the testimony of Galen, who tells us that the Egyptian king, Nechepsus, who lived six hundred and thirty years before the christian era, had written, that a green jasper cut into the form of a dragon surrounded with rays, if applied externally, would strengthen the stomach and organs of digestion.§ We have, moreover,

* Some writers have so far trifled with the subject as to have made it a question of grave inquiry, whether medicine or surgery can claim the higher antiquity? According to Sextus Empiricus, the earliest exercise of the art was that of extracting arrows, and hence he derives from ἰὸς, an arrow, the ἰατρος of the Greeks. Previous to the establishment of the Alexandrian school, about three centuries before the christian era, all the branches of physic and surgery were practised by the same person, the ἰατρος of the Greeks corresponding with the general practitioner of the present day.

† The application of the reeking entrails of a recently slain animal appears to have been one of the earliest means adopted for the relief of pain; and it is not more than two centuries since Dr. Butler of Cambridge ordered a cow to be killed, and his patient to be placed in the warm carcass.—*Aubrey's MSS. in Ashmole's Museum.*

‡ The words "*Incantation*" and "*Charm*" appear to be derived from the ancient practice of curing diseases by poetry and music (*Carmen*). Thus Cœlius Aurelianus, "*decantare loca dolentia.*" Democritus says that many diseases are capable of being cured by the sound of a flute, when properly played. Marianus Capellus assures us that fevers may be cured by appropriate songs. Asclepiades actually employed the trumpet for the relief of sciatica, and tells us that it is to be continued until the fibres of the part begin to palpitate, when the pain will vanish.

§ A similar superstition is still practised by the Indians. There is a species of green jasper found in many parts of America, particularly in New Spain, to which the Spaniards have given the name of *Piedra de la*

the authority of the Scriptures in support of this opinion; for what were the ear-rings which Jacob buried under the oak of Sechem, as related in Genesis, but amulets? And we are informed by Josephus, in his history of the Jews,* that Solomon discovered a plant efficacious in the cure of epilepsy, and that he employed the aid of a charm or spell for the purpose of assisting its virtues. The root of the herb was concealed in a ring, which was applied to the nostrils of the demoniac; and Josephus remarks that he himself saw a Jewish priest practise the art of Solomon, with complete success, in the presence of Vespasian, his sons, and the tribunes of the Roman army. From this art, exhibited through the medium of a ring or seal, we have the eastern stories which celebrate the *Seal of Solomon*,† and record the potency of its sway over the various orders of genii who were supposed to be the invisible tormentors or benefactors of the human race. Nor were such means confined to dark and barbarous ages; Theophrastus pronounced Pericles to be insane, because he discovered that he wore amulets about his neck; and, in the declining era of the Roman empire, we find that this superstitious custom was so general, that the Emperor Caracalla was induced to issue a public edict, ordaining that no man should wear superstitious amulets about his person.‡

Hyada, and is used for curing the cholic, by being applied to the navel.

* Lib. viii. c. ii. 5.

† The plant termed Solomon's Seal (*Convallaria Polygonatum*) is now employed as a popular application to remove the marks of bruises, for which purpose its fresh *rhizome* is applied as a cataplasm.

‡ That this custom was very general amongst the early Christians, may be inferred from the severe laws of the church against such heresy. The Council of Laodicea (*Canon xxvi.*) condemns clergymen who thus offended to be cast out of the church. St. Chrysostom also, in dissuading Christians from running to the Jews, who pretended to cure diseases by such methods, indignantly exclaims, "Christians are to obey Christ, and not to fly to his enemies, though they pretend to work cures by enchantments, amulets, and witchcraft. Jew physicians were long held in great estimation, in consequence of their general communication with all

In the progress of civilization, various fortuitous incidents, and even errors, in the choice and preparation of aliments, must have gradually unfolded the salutary or deleterious qualities of many natural substances;* these were recorded, and the authentic history of medicine may date its commencement from such records.

The Chaldeans and Babylonians, we are told by Herodotus, carried their sick to the public roads and markets, that travellers might converse with them, and communicate such remedies as had been successfully employed in similar cases. This custom continued for many ages in Assyria, and Strabo states that it prevailed also amongst the ancient Lusitanians or Portuguese. In this manner, however, the results of experience descended only by oral tradition. It was in the temple of Esculapius, in Greece, that medical information was first regularly recorded. Diseases and their cures were there duly registered on tablets of marble; the priests and priestesses, who were the guardians of the temple, prepared the remedies, and directed their application: and thus commenced the prac-

parts of the known world, and especially with parts of it which were unknown to the christian nations; hence they had means of obtaining drugs from the East, and the knowledge of what remedies were in use there. There is a remarkable instance of the esteem in which they were held for their supposed superiority as late as the sixteenth century. Francis I., after a long illness, in which he received no benefit from his own physicians, despatched a courier into Spain, requesting Charles V. to send him the most skilful Jewish practitioner in his dominions. The Emperor, however, sent a new christian physician, with whom he supposed Francis would be equally satisfied; but when this person arrived in France, the king, by way of familiar discourse, sportively asked him, "If he were not yet tired of expecting the Messiah?" Such a question produced from the new convert a declaration that he was a Christian, upon which the king immediately dismissed him, and sent for a Jew to Constantinople.

* Let the tradition respecting the discovery of the virtues of Peruvian bark serve as an illustration. We are told that an Indian, being ill of a fever, quenched his thirst at a pool of water strongly impregnated with the bark from some trees that had accidentally fallen into it, and that he was in consequence cured of his malady.

tice of physic as a regular profession.* With respect to the actual nature of these remedies, it is useless to inquire—the lapse of ages, loss of records, change of language, and ambiguity of description, have rendered every learned research unsatisfactory; indeed, we are in doubt as to many of the remedies which even Hippocrates employed. It is, however, clearly shown by the earliest records, that the ancients were in possession of many powerful remedies; thus Melampus of Argos, the most ancient Greek physician with whom we are acquainted, is said to have cured one of the Argonauts of sterility by administering the rust of iron in wine for ten days; and the same physician used hellebore as a purge in the case of the daughters of King Prætus, who were afflicted with melancholy. Venesection was also a remedy of very early origin, for Podalirius, on his return from the Trojan war, cured the daughter of Damethus, who had fallen from a height, by bleeding her in both arms; and the practice of incision and scarification was employed in the Grecian camps before Troy. Opium, or some preparation of the poppy, was certainly known in the earliest ages; and it has been conjectured that it was opium that Helen mixed with wine, and gave to the guests of Menelaus, under the expressive name of *Nepenthe*,† to drive away their cares; and the conjecture certainly receives some support from the fact that the *Nepenthe*

* These official persons were ambitious to pass as the legitimate descendants of Esculapius, and therefore assumed the title of the Asclepiades. The writings of Pausanias, Philostratus, and Plutarch, abound with an account of the artifices of these early physicians. Aristophanes describes in a truly comic manner the craft and pious avarice of these godly men, and mentions the dexterity and promptitude with which they collected and put into their bags the offerings on the altar. The patients during this period reposed on the skins of sacrificed rams, in order that they might procure celestial visions. As soon as they were believed to be asleep, a priest, cloked in the dress of Esculapius, imitating his manners, and accompanied by the daughters of the god, that is, by young actresses thoroughly tutored in their parts, entered, and solemnly delivered a medical opinion.

† Odyss. Δ.

of Homer was obtained from the Egyptian Thebes.* Sir Henry Halford, however, has observed that *Hyoscyamus* is used at Constantinople, and throughout the Morea at this day, under the name of *Nebensch*, which sounds so like *Nepenthe*, that we are led to suspect that hyoscyamus had been known from early times as a narcotic; and if we may credit the opinion of Dr. Darwin, the Cumæan Sibyl never sat on the portending tripod without first swallowing a few drops of the juice of the *cherry-laurel*.†

> "At Phœbi nondum patiens, immanis in antro
> Bacchatur Vates, magnum si pectore possit
> Excussisse deum: tanto magis ille fatigat
> Os rabidum, fera corda domans, fingitque premendo."
>
> *Æn.* lib. vi. 76.

There is reason to believe that the pagan priesthood were under the influence of some powerful narcotic during the display of their oracular powers; but the effects produced would appear to resemble rather those of opium, or perhaps of stramonium, than of the prussic acid. Monardes tells us that the priests of the American Indians, whenever they were consulted by the chief persons, or *casiques* as they are called, took certain leaves of the tobacco, and cast them into the fire, and then received the smoke, which they thus produced, in their mouths; in consequence of which they fell down upon the ground, and that, after remaining some time in a stupor, they recovered, and delivered the answers which they pretended to have received during their supposed intercourse with the world of spirits.

The sedative powers of the *lactuca sativa*, or lettuce, were known also in the earliest times.‡ Amongst the fables of

* Hence the tincture of opium has been called *Thebaic* tincture.

† The laurel was sacred to Apollo, with plantations of which his temples were surrounded. Lucan informs us that the speedy death of the priestess was often occasioned by the ceremony.—(*Pharsal.* lib. v.)

‡ Allusions to this plant frequently occur in the medical writings of antiquity; we are told that Galen, in the decline of life, suffered much from morbid vigilance, until he had recourse to eating a lettuce every evening, which cured him.

antiquity we read that, after the death of Adonis, Venus threw herself on a bed of lettuces to lull her grief and repress her desires. The sea onion, or *squill*, was administered in cases of dropsy by the Egyptians, under the mystic title of the *Eye of Typhon;* and the application of spirit to wounds was practised by the Greeks; for we find the experienced Nestor applying a cataplasm, composed of cheese, onion, and meal, mixed up with the wine of Pramnos, to the wounds of Machaon.

In tracing the history of the Materia Medica from its earliest periods, we shall find that its progress towards its present advanced state has been very slow and unequal, very unlike the steady and successive improvement which has marked other branches of natural knowledge; we shall perceive even that its advancement has been continually arrested, and often entirely subverted, by the caprices, prejudices, superstitions, and knavery of mankind; unlike, too, the other branches of science, it is incapable of successful generalisation; in the history of remedies, when are we able to produce a discovery or improvement which has been the result of that happy combination of observation,* analogy, and experiment, which has so eminently rewarded the labours of modern science? Thus, OBSERVATION led Newton to discover that the refractive power of transparent substances was, in general, in the ratio of their density, but that, of substances of equal density, those which possessed the refractive power in a higher

* "OBSERVATION," says Professor Leslie, "is the close inspection and attentive examination of those phenomena which arise in the course of Nature; EXPERIMENT, as the term implies, consists in a kind of trial, or artificial selection and combination of circumstances for the purpose of searching after the remote results." The philosopher, therefore, who *observes,* may be said to listen to nature, while he who *experiments,* interrogates her. Herschel, however, very justly states, that by thus distinguishing observation from experiment, it is by no means intended to place them in any kind of contrast; essentially they are much alike, and differ rather in degree than in kind; so that he thinks it might be better to express their distinction by the terms *passive* and *active* observation.

degree, were inflammable.* ANALOGY induced him to conclude that, on this account, water must contain an inflammable principle, and EXPERIMENT enabled Cavendish and Watt to demonstrate the surprising truth of Newton's induction, in their immortal discovery of the chemical decomposition of that fluid.

But it is clear that such principles of research and combination of methods can rarely be applied in the investigation of remedies ;† for every problem which involves the phenomena

* The refractive power of an inflammable body bears also a proportion to its perfection, whence it may be sometimes used as a test of its purity. Thus, Dr. Wollaston found that genuine oil of cloves had a refractive power of 1·535, while that of an inferior quality did not exceed 1·498.

† It is indeed true that Sir John Herschel has lately presented us with the history of a medical discovery, which might vie with the most triumphant examples of Baconian induction; but Sir John is sanguine, I will not say credulous. The reader, however, shall receive the account of it in his own words :—"A soap manufacturer remarks, that the residuum of his ley, when exhausted of the alkali for which he employs it, produces a corrosion of his copper boiler, for which he cannot account. He puts it into the hands of a scientific chemist for analysis, and the result is the discovery of one of the most singular and important chemical elements, *iodine*. The properties of this, being studied, are found to occur most appositely in illustration and support of a variety of new, curious, and instructive views then gaining ground in chemistry, and thus exercise a marked influence over the whole body of that science. Curiosity is excited; the origin of the new substance is traced to the sea plant from whose ashes the principal ingredient of soap is obtained, and ultimately to the sea water itself. It is thence hunted through nature, discovered in salt mines and springs, and pursued into all bodies which have a marine origin; among the rest into sponge. A medical practitioner (Dr. Coindet of Geneva) then calls to mind a reputed remedy for the cure of one of the most grievous and unsightly disorders to which the human species is subject—the *goître*—which infests the inhabitants of mountainous districts to an extent that in this favoured land we have happily no experience of, and which was said to have been originally cured by the ashes of burnt sponge. Led by this indication, he tries the effect of iodine on that complaint, and the result establishes the extraordinary fact, that this singular substance, taken as a medicine, acts with the utmost promptitude and energy on *goître*, dissipating the largest and most inveterate in a short time, and acting (of course like all medicines, even the most approved, with occasional failures) as a specific or natural antagonist against that odious deformity."

of life is unavoidably embarrassed by circumstances, so complicated in their nature, and fluctuating in their operation, as to set at defiance every attempt to exclude their presence, to neutralize their influence, or to appreciate, and allow for, the extent of their operation; an observation or experiment upon the effects of a medicine is thus liable to a thousand fallacies, unless it be carefully repeated under all the varying circumstances of health and disease, in different climates, and on different constitutions. We all know how very differently opium or mercury will act upon different individuals, or even upon the same individual at different times, or under different circumstances; the effect of a stimulant upon the living body is not in the ratio of the intensity of its impulse, but in proportion to the degree of vital susceptibility or excitability of the individual to whom it is applied. This is illustrated in a clear and familiar manner by the very different sensations of heat, which the same temperature will produce under different circumstances. In the road over the Andes, at about halfway between the foot and the summit, there is a cottage in which the ascending and descending travellers meet; the former, who have just quitted the sultry valleys at the base, are so relaxed, that the sudden diminution of temperature produces in them the feeling of intense cold; whilst the latter, who have left the frozen summits of the mountain, are overcome by the distressing sensation of extreme heat. But we need not climb the Andes for illustration,—if we plunge one hand into a basin of hot, and the other into one of cold water, and then mix the contents of each vessel, and replace both hands in the mixture, we shall experience the sensation of heat and cold from one and the same medium; the hand that had been previously in the hot will feel cold, whilst that which had been immersed in the cold water will experience a sensation of heat. Upon the same principle, ardent spirits will produce very opposite effects upon different constitutions and temperaments, and in different conditions of the body. In a state of health they will always increase the strength and frequency of the natural

pulse, whereas in disease, by giving power, they may reduce its frequency. Aliment, also, which under ordinary circumstances would occasion but little effect, may, in certain conditions of the system, act as powerful stimulants; a fact well exemplified by the history of persons who have been enclosed in a coal mine for several days without food, from the accidental falling in of the surrounding strata, when they have been as much excited by a basin of broth, as a person, under common circumstances, would have been by one or more bottles of wine.* Many instances will suggest themselves to the practitioner in farther illustration of these views, and I shall have occasion in a future part of the work to recur to the subject, in order to show its immense importance in guiding and modifying our practice.

To such causes we may principally attribute the barren labours of the ancient *empirics*, who saw without discerning, administered without discriminating, and concluded without reasoning; nor should we be surprised at the very imperfect state of the materia medica, as far as it depends upon what is commonly called *experience*, complicated as it is by its numberless relations with physiology, pathology, and chemistry, and obnoxious as it must ever be to all the prejudices of opinion, and to the illusions even of sense. John Ray attempted to enumerate the virtues of plants from *experience*, and the system serves only to commemorate his failure. Vogel likewise professed to assign to substances those powers which had been learnt from repeated observation, or, in other words, from accumulated experience; and he speaks of *roasted toad*†

* Elizabeth Woodcock, who was buried in the snow for the space of eight days in the neighbourhood of Cambridge, and whom I frequently visited, died in consequence of the stimulants which she could not resist, and which in her peculiar state of excitement she was unable to bear. In the first volume of the Memoirs of the Philosophical Society of Manchester, a case of a miner is recorded, who, after remaining for eight days without food, was killed by being placed in a warm bed, and fed with chicken-broth.

† For this purpose it appears that the toad was baked alive. The fol-

as a specific for the pains of gout, and asserts that a person may secure himself for the whole year from angina by eating a roasted swallow! Such must ever be the case, when medicines derive their origin from false experience, and their reputation from blind credulity.

Analogy has undoubtedly been a powerful instrument in the improvement, extension, and correction of the materia medica, but it has been chiefly confined to modern times; for, in the earlier ages, chemistry had not so far unfolded the composition of bodies, as to furnish any just idea of their relation to each other; nor had the science of botany taught us the value and importance of those natural affinities which exist in the vegetable kingdom; but these again are subjects to which I shall have occasion hereafter to recur. Nor has experiment been exempt from fallacy. If an experiment be regarded as a question addressed to Nature, it is evident, in order to avoid fallacy, that it is not only necessary it should be fairly and correctly stated, but that the response should be fully and correctly comprehended, or, like the oracles of old, it will only serve to puzzle and mislead us. As in the ordinary affairs of life nothing is more difficult than so to frame a searching question as to elicit an unembarrassed truth, so in philosophy, to contrive an experiment that shall give an unequivocal result, presupposes such an acquaintance with every probable interference as can only be possible in an advanced state of knowledge.

In addition to the obstacles already enumerated, the progress of our knowledge with respect to the virtues of medicines has met with others of a moral character, which have deprived us in a great degree of an obvious method of research, and rendered our dependence upon testimony uncertain, and often entirely fallacious. The human understanding, as Lord Bacon justly remarks, is not a mere faculty of apprehension, but is

lowing is the receipt in Colborne's Dispensatory: "*Bufo præparatus.* Put the toads alive in an earthen pot, and dry them in an oven moderately heated, until they become fit to be powdered."

affected more or less by the will and the passions; what man wishes to be true, that he too easily believes to be so, and I humbly conceive that, of all the sciences, Physic has the least pretensions to proclaim itself independent of such an influence.

Let us then proceed to investigate the revolutions and vicissitudes which remedies have undergone in medical as well as popular opinion, from the ignorance of some ages, the learning of others, from the superstitions of the weak, and the designs of the crafty; classing them under the prominent causes which have produced them, viz. Superstition; Credulity; Scepticism; False Theory; Devotion to Authority and Established Routine; the assigning to Art that which was the effect of unassisted Nature; the assigning to peculiar Substances properties deduced from Experiments made on inferior Animals; Ambiguity of Nomenclature; the Progress of Botanical Science; the application and misapplication of Chemical Philosophy; the Influence of Climate and Season on Diseases, as well as on the Properties of their Remedies; the unseasonable collection of Medicines of Vegetable Origin; the ignorant preparation or fraudulent adulteration of Medicines; and the obscurity which has attended the operation of Compound Remedies.

SUPERSTITION.

A belief in the interposition of supernatural powers in the prevention and cure of disease has prevailed in every age and country, in an inverse ratio with its state of civilization, or in the exact proportion to its want of knowledge. "In the opinion of the ignorant multitude," says Lord Bacon, "witches and impostors have always held a competition with physicians."

Galen also complains of this circumstance, and observes that his patients were more obedient to the oracle in the temple of Esculapius, or to their own dreams, than they were to his prescriptions. The same popular imbecility is evidently allegorized in the mythology of the ancient poets, when they made both Esculapius and Circe the children of Apollo. In truth, there is an unaccountable propensity in the human mind, unless subjected to a very long course of discipline, to indulge in the belief of what is improbable and supernatural; and this is perhaps more conspicuous with respect to physic than to any other affair of common life, both because the nature of diseases and the art of curing them are more obscure, and because disease necessarily awakens fear, and fear and ignorance are the natural parents of superstition. Every disease, therefore, the origin and cause of which did not immediately strike the senses, has in all ages been attributed by the ignorant to the wrath of Heaven, to the resentment of some invisible demon, or to some malignant aspect of the stars;* and hence the introduction of a rabble of superstitious remedies, not a few of which were rather considered as expiations at the shrines of offended spirits, than as natural agents possessing medicinal

* The plague of London was supposed to have arisen from such a cause, as we learn from the writers of that period. I shall quote a passage from a pamphlet by W. Kemp, M.A., dedicated to Charles the Second. "One cause of breeding the pestilence is that corruption of the air which is occasioned by the influence of the stars, by the aspects, conjunctions, and oppositions of the planets, by the eclipses of the sun and moon, and by the consequences of comets. 'Astra regunt homines, sed regit astra Deus.' Hippocrates advises his son Thessalus to study numbers and geometry, (Epist. ad Thessalum,') because, says he, the rising and setting of the stars have a great effect upon distempers. Citois, the historian of the celebrated Colic of Poitou, (Colica Pictonum,) which raged with such epidemic fury in that province during the sixteenth century, drops a hint, apparently with a view to account for the origin of the disease, viz. that to the great astonishment of astrologers, "a new star had, in the same year, made its appearance in the constellation of Cassiopeia." (Diatriba de novo et populari, apud Pictones, dolore colico bilioso.) This temporary star, observed by Cornelius Gemma, was said to have been so bright as to have been seen at noon-day.

powers. The introduction of precious stones into the Materia Medica arose from an Arabian superstition of this kind; indeed, De Boot, who has written extensively upon this subject, does not pretend to account for the virtues of gems upon any philosophical principle, but from their being the residence of spirits; and he adds, that such substances, from their beauty, splendour, and value, are well adapted as receptacles for *good* spirits.*

Every substance whose origin is involved in mystery,† has at different times been eagerly applied to the purposes of medicine. Some years since, one of those showers, which are now known to consist of the excrements of insects, fell in the north of Italy; the inhabitants regarded the substance as manna, or some supernatural panacea, and they swallowed it with such avidity, that it was only by extreme address a small quantity could be obtained for a chemical examination.

A propensity to attribute every ordinary and natural effect to some extraordinary and unnatural cause, is one of the striking characteristics of medical superstition; it seeks also explanations from the most preposterous agents, when obvious

* The precious stones were, at first, only used as amulets, or external charms; but, like many other articles of the Materia Medica, they passed, by a mistake in the mode of their application, from the outside to the inside of the body, and they were accordingly powdered and administered as specifics. An analogous case of the perverted administration of a popular remedy is afforded in the history of the tench; which Sennertus describes as a remedy capable of curing the jaundice, which he allows is effected "by secret attraction, and the power of amulets." In the course of time it became a reputed food in the cure of that disease, and tench broth was prescribed upon all such occasions. Old Isaac Walton has some curious observations upon the remedial power of the tench.

† Mystery is the very soul of empiricism; withdraw the veil, and the confidence of the patient instantly languishes. Thus Pliny: "*Minus credunt quæ ad salutem pertinent, si intelligunt.*" Of this truth, the history of Mrs. Stephens's remedy for stone affords a good example; while kept secret, everybody believed it infallible, but no sooner was its composition divulged, than it fell into neglect and disuse: and who can doubt that the fame of the homœopathic doctrine has not arisen from its being perfectly unintelligible?

and natural ones are in readiness to solve the problem. Soranus, for instance, who was contemporary with Galen, and wrote the life of Hippocrates, tells us that honey proved an easy remedy for the aphthæ of children; but instead of at once referring the fact to the medical qualities of the honey, he very gravely explains it, from its having been taken from bees that hived near the tomb of Hippocrates! And even those salutary virtues which many herbs possess, were, in those times of superstitious delusion, attributed rather to the planet under whose ascendency they were collected or prepared, than to any natural and intrinsic properties in the plants themselves; indeed, such was the supposed importance of planetary influence,* that it was usual to prefer to receipts a symbol of the planet under whose reign the ingredients were to be collected; and it is, perhaps, not generally known, that the character which we at this day place at the head of our prescriptions, and which is understood to mean nothing more than *Recipe*, is in fact a relict of the astrological symbol of Jupiter, as may be seen in many of the older works on pharmacy; although it is at present so disguised by the addition of

* Paracelsus exclaims, "Stellas terrenas esse Plantas, quæ cælestes plantas, i. e. Stellas, respiciant, ita ut quævis planta suam habeat stellam specificam."

The Druids of Gaul and Britain, who were both priests and physicians, gathered and cut the *mistletoe* with a golden knife, only when the moon was six days old; and being afterwards consecrated by certain forms, it was considered as an antidote to poisons, and a preventive of sterility. Plinii, lib. xvi. c. xliv.

The *vervain* (Verbena Officinalis,) after libations of honey, was to be gathered at the rising of the dog-star, when neither sun nor moon shone, with the left hand only; when thus prepared, it was said to vanquish fevers and other distempers, was an antidote to the bite of serpents, and a charm to conciliate friendship. Plin. lib. xxv. c. ix. I shall, however, hereafter show that the medicinal reputation of this herb derived its origin from a source more ancient even than that of Druidism. Magnenus (Exercitat. de Tabaco) has given us the following precept,—"Tabacum seratur luna *crescente*, colligatur autem *decrescente* luna."—From Shakspeare we receive illustrations on every subject. See Friar Lawrence's Speech in Romeo and Juliet, Act ii. Sc. iii.

the down stroke, which converts it into the letter R, that, were it not for its *cloven* foot, we might be led to question its superstitious origin.*

A knowledge of this ancient and popular belief in sideral influence will enable us to explain many superstitions in physic. The custom, for instance, of administering cathartic medicines at stated periods and seasons, originated in an impression of their being more active and necessary at particular stages of the moon, or at certain conjunctions of the planets. A remnant of this superstition still exists to a considerable extent in Germany; and the practice of bleeding at "*spring and fall*," so long observed in this country, owed its existence to a similar belief. Our Saxon ancestors relied much upon bleeding, but its success was supposed to depend very greatly upon the selection of the day, whether good or evil, upon which it was performed; and the Anglo-Saxon manuscripts contain lists of the attributes of each day of the lunar month, as they were supposed to be good or evil, for the administration of remedies. It was in consequence of the same superstition that the metals were first distinguished by the names and signs of the planets; and as the latter were supposed to hold dominion over time, so were astrologers led to believe that some, more than others, had an influence on certain days of the week; and moreover that they could impart to the corresponding metals considerable efficacy upon the

* Mesue commenced all his prescriptions with the words, "*In nomine Dei.*"

In later times the heathen symbols were dropped, and others were substituted to propitiate the favour and assistance of heaven. For this purpose the alchemists stamped the figure of the cross upon the vessel in which they were to obtain their long sought prize; a superstition from which the term *Crucible* derived its origin: although I am well aware that another derivation has been suggested, from *Crucio*, since, in the language of the alchemists, the crucible was the vessel in which the metals were *tortured* to force them to assume the form of gold.

particular days which were devoted to them. From this same belief, some bodies were only prepared on certain days in the year; the celebrated *earth* of *Lemnos* was, as Galen describes, periodically dug with great ceremony, and it continued for many ages to be highly esteemed for its virtues; even at this day, the pit in which the clay is found is annually opened with solemn rites by the priests on the sixth day of August, six hours after sunrise, when a quantity is taken out, washed, dried, and then stamped with the Grand Seignior's seal, and sent to Constantinople. It was formerly death to open the pit, or to seal the earth, on any other day in the year.

In the botanical history of the middle ages, as more especially developed in Macer's Herbal, there was not a plant of medicinal use that was not placed under the dominion of some planet, and must neither be gathered nor applied, but with observances that savoured of the most absurd superstition, and which we find were preserved, as late as the seventeenth century, by the astrological herbalists, Turner, Culpepper, and Lovel.

It is not the least extraordinary feature in the history of medical superstition, that it should have so frequently involved in its trammels persons who, on every other occasion, would have resented with indignation any attempt to talk them out of their reason, and still more so to persuade them out of their senses; and yet we have continual proofs of its extensive influence over the most powerful and cultivated minds. In ancient times we might adduce the wise Cicero, and the no less philosophic Aurelius; while, in modern days, we find that Lord Bacon,* with all his philosophy, betrayed a disposition to believe in charms and amulets.

* Lord Bacon believed in the existence of a panacea that would prolong life beyond its natural term. He considered that one principal cause of death was the action of the external air in drying and exhausting the body, which he thought might be prevented by nitre; but, although this great man took three grains of his favourite salt every morning for the last thirty years of his life, he died at the age of sixty-six.

It merits notice, that the medicinal celebrity of a substance has not unfrequently outlived the tradition of its superstitious origin, in the same manner that many of our popular customs and rites have continued, through a series of years, to exact a respectful observance, although the circumstances that gave rise to them have been lost in the gloom of unrecorded ages. They are, as it were, the orphans of history, and would appear to rivet a regard from the very obscurity of their origin. Does not the fond parent still suspend the coral toy around the neck of her infant, without being in the least aware of the superstitious belief* from which the custom originated? while the chorus of *Derry down* is re-echoed by those who never heard of the Druids, much less of the choral hymns with which their groves resounded at the time of their gathering the mistletoe. And how many a medical practitioner has administered that sacred plant (*Viscus Quercinus*) for the cure of his epileptic patient, without the least suspicion that it was indebted for its reputation to the same mysterious source of superstition and imposture? Nor is this the only faint

* The soothsayers attributed many mystic properties to the coral, and it was believed to be capable of giving protection against the influence of "*evil eyes*;" it was even supposed that coral would drive away devils and evil spirits; hence arose the custom of wearing amulets, composed of it, around the neck, and of making crowns of it. Pliny and Dioscorides are very loud in their praises of the medicinal properties of this substance, and Paracelsus says that it should be worn around the necks of infants as an admirable preservative against fits, sorcery, charms, and even against poison. The bells which are commonly suspended to it were originally intended to frighten away evil spirits, and not to amuse the child by their jingling sounds. It is a curious circumstance, that the same superstitious belief should exist among the Negroes of the West Indies, who affirm that the colour of coral is always affected by the state of health of the wearer, it becoming paler in disease. In Sicily it is also commonly worn as an amulet, by persons of all ranks, as a security against an evil eye; a small twisted piece, somewhat resembling a horn, is worn at the watch-chain, under the name of "*Buon Fortuna*," and is occasionally pointed at those who are supposed to entertain evil intentions. His late Sicilian Majesty was celebrated for his faith in and frequent use of the "*Buon Fortuna*."

vestige of Druidism which can be adduced. Mr. Lightfoot states, with much plausibility, that in the highlands of Scotland, evidence still exists in proof of the high esteem in which these ancient magi held the quicken-tree, or mountain-ash ; (*Sorbus Aucuparia ;*) for it is more frequently than any other tree found planted in the neighbourhood of Druidical circles of stones ; and it is a curious fact that it should still be believed that a small part of this tree carried about a person is a charm against all bodily evils. The dairy-maid drives the cattle with a switch of the *roan*-tree, for so it is called in the highlands ; and in one part of Scotland the sheep and lambs are, on the first of May, even made to pass through a hoop of *roan wood.*

It is, however, necessary to state that many of the practices which superstition has at different times suggested, although in themselves extremely absurd, have by accident possessed natural powers of considerable efficacy, or have led to results and discoveries of great practical importance. The most remarkable instance of this kind upon record is, that of the *sympathetic powder** of Sir Kenelm Digby, Knight of Montpelier. Whenever any wound had been inflicted, this powder was applied to the weapon that had inflicted it, which was, moreover, covered with ointment, and dressed two or three times a day.† The wound itself, in the mean time, was directed

* See Sir Kenelm Digby's Discourse upon the Cure by Sympathy, pronounced at Montpelier before an assembly of nobles and learned men, translated into English by R. White, gentleman, and published in 1658. King James I. obtained from Sir Kenelm the discovery of this great secret, which he pretended had been taught him by a Carmelite friar, who had learned it in Persia. The powder, as we learn from contemporary physicians, was "*calcined green vitriol.*"

† This superstitious practice is repeatedly alluded to by the poets. Thus Dryden has introduced it in his *Enchanted Island,* Act v. sc. 2.

"*Ariel.* Anoint the sword which pierced him
With this weapon salve, and wrap it close from air
Till I have time to visit it again."

Again, in scene iv., Miranda enters with Hippolito's sword wrapt up.

"*Hip.* O my wounds pain me. [*She unwraps the sword.*

to be brought together, and carefully bound up with clean linen rags, but, ABOVE ALL, TO BE LET ALONE for seven days; at the end of which period the bandages were removed, when the wound was generally found perfectly united. The triumph of the cure was decreed to the mysterious agency of the *sympathetic powder* which had been so cunningly applied to the weapon, whereas it is hardly necessary to observe, that the promptness of the cure depended upon the total exclusion of air from the wound, and upon the sanative operations of Nature, not having received any disturbance from the officious interference of art. The result, beyond all doubt, furnished the first hint which led surgeons to the improved practice of healing wounds by what is technically called the "*first intention.*"

The rust of the spear of Telephus, mentioned in Homer as a cure for the wounds which that weapon inflicted, was probably *verdegris*, and led to the discovery of its use as a surgical application.

Soon after the introduction of gunpowder, *cold water* was very generally employed throughout Italy, as a dressing to gunshot wounds; not, however, from any theory connected

Mir. I am come to cure you.
Hip. Alas! I feel the cold air come to me;
My wound shoots worse than ever.
Mir. Does it still grieve you? [*She wipes and anoints the sword.*
Hip. Now, methinks, there's something laid upon it.
Mir. Do you find no ease?
Hip. Yes, yes,—upon the sudden all this pain
Is leaving me—sweet heaven! how am I eased?"

Then again, Sir Walter Scott, in *The Lay of the Last Minstrel*:—

"But she has ta'en the broken lance,
And wash'd it from the clotted gore,
And salved the splinter o'er and o'er.
William of Deloraine, in trance,
When'er she turn'd it round and round,
Twisted, as if she gall'd his wound;
Then to her maidens she did say,
That he should be whole man and sound."

Canto iii. *st.* xxii.

with the influence of diminished temperature or moisture, but from a supposed supernatural agency imparted to it by certain mysterious and magical ceremonies, which were daily performed immediately previous to its application. The continuance of the practice, however, threw some light upon the surgical treatment of these wounds, and led to a more rational management of them. In like manner, who can doubt that a drink, in which a ring taken from the finger of St. Remigius had been immersed, proved a very useful febrifuge diluent?

The inoculation of the small-pox in India, Turkey, and Wales, observes Sir Gilbert Blane, was practised on a superstitious principle long before it was introduced as a rational practice into this country. The superstition consisted in buying it—for the efficacy of the operation, in giving safety, was supposed to depend upon a piece of money being left by the person who took it for insertion. I well remember, during the year I was a member of the National Vaccine Board, that we received from Mr. Dubois, a missionary in India, a very interesting account of the services derived from superstitious influence in propagating the practice of vaccination through that uncivilized part of the globe. It appeared from this document that the greatest obstacle which it encountered was a belief that the natural small-pox was a dispensation of a mischievous deity among them, whom they called Mah-ry Umma; or rather, that this disease was an incarnation of the dire goddess herself into the person who was infected with it. The fear of irritating her, and of exposing themselves to her resentment, necessarily rendered the natives of the East decidedly averse to vaccination, until a superstitious impression, equally powerful with respect to the new practice, was happily effected; this was no other than a belief that the goddess Mah-ry Umma had spontaneously chosen this new and milder mode of manifesting herself to her votaries, and that she might therefore be worshipped with equal respect under this new shape.

Hydromancy is another superstition which has incidentally

led to the discovery of the medicinal virtues of many mineral waters. A belief in the divining nature of certain springs and fountains is, perhaps, the most ancient and universal of all superstitions. The Castalian fountain, and many others amongst the Greeks, were supposed to be of a prophetic nature. By dipping a fair mirror into a well, the patræans of Greece received, as they imagined, some notice of ensuing sickness or health. At this very day the sick and lame are attracted to various hallowed springs; and to this practice, which has been observed for so many ages, and in such different countries, we are no doubt indebted for a knowledge of the sanative powers of many mineral waters. There can be no doubt, moreover, that in many cases, by affording encouragement and confidence to a dejected patient, and serenity to his mind, whether by the aid of reason, or the influence of faith, much benefit may arise; for the salutary and curative effects of Nature, in such a state of exhilaration, will be much more likely to succeed. This powerful influence was well understood by the sages of antiquity. The Romans, in times of pestilence, elected a dictator with great solemnity, for the sole purpose of driving a nail into the wall of the temple of Jupiter:* the effect was generally instantaneous; and while they thus imagined that they propitiated an offended deity, they in truth did but diminish the susceptibility of disease by appeasing their own fears.

In the celebrated siege of Breda, in 1625, by Spinola, the garrison suffered extreme distress from the ravages of scurvy; and the Prince of Orange, being unable to relieve the place, sent in by a confidential messenger a preparation which was directed to be added to a very large quantity of water, and to be given as a specific for the epidemic; the remedy was administered, and the garrison recovered its health, when it was afterwards acknowledged that the substance in question was no other than a little colouring matter.

* Livii, lib. viii. cap. 18.

In my Life of Sir Humphry Davy, I have published an anecdote which was communicated to me by the late Mr. Coleridge, and which bears so strikingly upon the present subject that I must be excused for repeating it. As soon as the powers of *nitrous oxide* were discovered, Dr. Beddoes at once concluded that it must necessarily be a specific for paralysis: a patient was selected for the trial, and the management of it was entrusted to Davy. Previous to the administration of the gas, he inserted a small pocket thermometer under the tongue of the patient, as he was accustomed to do upon such occasions, to ascertain the degree of animal temperature, with a view to future comparison. The paralytic man, wholly ignorant of the nature of the process to which he was to submit, but deeply impressed, from the representations of Dr. Beddoes, with the certainty of its success, no sooner felt the thermometer under his tongue, than he concluded the *talisman* was in full operation, and in a burst of enthusiasm declared that he already experienced the effect of its benign influence throughout his whole body: the opportunity was too tempting to be lost; Davy cast an intelligent glance at Mr. Coleridge, and desired his patient to renew his visit on the following day, when the same ceremony was performed, and repeated every succeeding day for a fortnight, the patient gradually improving during that period, when he was dismissed as cured, no other application having been used. Dr. James Gregory used to relate in his lectures an instance of the power of the imagination in influencing the operation of a medicine, which may be here aptly introduced. One of his pupils, who laboured under fever, being unable to obtain any rest, was told that an opiate had been prescribed for him at bed-time; but the student misunderstood the doctor, and supposed that he was to take a purgative. Accordingly, when the physician saw his patient on the following morning, and inquired whether his opiate had procured for him any sleep, "Opiate!" exclaimed the patient, "I understood it was pur-

gative, and very actively has it operated, and I am much relieved by it.*

* Dr. Holland, in his "*Medical Notes and Reflections*," has introduced a very interesting chapter on the "*Effects of Mental Attention on Bodily Organs*," which well merits the regard of the medical philosopher. It is stated that the simple act of concentrating the attention upon any particular organ by a distinct voluntary effort, without the suggestions of any previous sensation from the organ in question, will effect in it some change, both as it regards the sensation derived from it, and its functional activity. In illustration of which, he adduces the familiar fact of the bladder being urged to act, when not otherwise disposed, by simply directing our consciousness to it, and to the want being as immediately removed by withdrawing our attention from it. In like manner, in that state of skin, however produced, of which general itching is the symptom, the attention directed upon any particular part will very often bring the sensation immediately to it. A similar direction of consciousness to the stomach creates a sensation of uneasiness in that part; if to the bowels, their action may be excited and quickened. Upon the same principle, the author very rationally supposes that certain of the results of animal magnetism may be explained. He might have adduced the well-known story of John Hunter, who, upon placing himself under the hands of one of these magical operators, and being told that he must expect certain sensations in the head, determined to concentrate all his attention upon his great toe, and declared that, after a certain interval, he became conscious of a peculiar feeling in it. In attempting a physical explanation of the phenomena, Dr. Holland asks whether that transference of consciousness, by volition, to particular parts, which has been called *Attention of Mind*, takes place through some branch of the nervous system, as volitions are conveyed to the muscular organs? And he inclines to the opinion that the nerves are in some manner excited by the act of attention, and that all particular and local effects on the body are produced through their agency; but here another question presents itself—through what class of nerves is this carried on? Those of voluntary motion can scarcely be admitted, since motion is no part of the effect; and the influence, moreover, extends to parts over which we have little or no voluntary power. Can the nerves of sensation be the agents?—if so, we must admit two several actions in opposite directions along the same tract of nerve. In truth, as Dr. Holland confesses, in neither of these functions, nor in the nerves ministering to them, can we find any sure explanation of the phenomena. It appears to me that the agency of the nerves is not at all required for the production of these effects, and that all the phenomena may be more satisfactorily explained by referring them to certain changes in a great nervous centre. Every part of the living body is represented in the brain, and all its sensations

Amongst the numerous instances which have been cited to show the power of faith over disease, or of the mind over the bodily organs, *the cures performed by royal touch* have been considered the most extraordinary:* but it would appear, upon the authority of Wiseman, that the cures which were thus effected were in reality produced by a very different cause; for he states that part of the duty of the royal physicians and serjeant surgeons was to select such patients afflicted with scrofula as evinced a tendency towards recovery, and that they took especial care to choose those who approached the age of puberty. In short, those only were produced whom Nature had shown a disposition to cure; and as the touch of the king, like the sympathetic power of Digby, secured the patient from the mischievous importunities of art, so were the efforts of Nature left free and uncontrolled, and the cure of the disease was not retarded or opposed by the administration of adverse remedies. The wonderful cures of Valentine Greatricks, performed in 1666, which were witnessed by contemporary prelates, members of parliament, and fellows of the Royal Society, amongst whom was the celebrated Mr. Boyle, would probably, upon investigation, admit of a similar explanation. It deserves, however, to be noticed, that in all records of extraordinary cures performed by mysterious agents, there

are perceived there, and there only; it is thus that a patient, after the amputation of his leg, will experience pains in the foot of that limb. It is surely, then, as easy to conceive that, in the act of directing our attention to a particular part of the body, we at once impress a certain influence upon that portion of the brain in which the sensations of such a part are perceived, as it is to suppose that by an effort of volition we are able to transmit the influence to the part itself through a tract of nerves, to be sent back to the brain. This theory, however, will only explain the phenomena of local sensation; to account for functional changes in the organs themselves from the stimulus of attention, we must have recourse to the doctrine of reflex action.

* Edward the Confessor was the first English king who "touched for the evil," but the foolish superstition has been wisely laid aside since the accession of the House of Hanover. Dr. Johnson, when thirty months old, was taken by his mother to London to be touched by Queen Anne, and Boswell says it was done by the advice of Sir John Floyer, a physician at Lichfield.

has always been a desire to conceal the remedies and other curative means which might have been simultaneously administered. Thus Oribasius commends, in high terms, a necklace of *peony-root* for the cure of epilepsy; but we learn that he always took care to accompany its use with copious evacuations, although he assigns to them not the least share of credit in the cure. In later times, we have an excellent specimen of this species of deception, presented to us in a work on scrofula by Mr. Morley, written, as we were informed, for the sole purpose of restoring the much-injured character and use of the *vervain;* in which the author directs the root of that plant to be tied with a *yard of white satin riband* around the neck;—but mark—during the period of its application, he calls to his aid the most active medicines in the materia medica. "It is unquestionable," says Voltaire, speaking of sorceries, "that certain words and ceremonies will effectually destroy a flock of sheep, if administered with a sufficient portion of arsenic."

The advantages which I have stated to have occasionally arisen from superstitious influence, must be understood as being generally accidental: indeed, in the history of such practices, we do not usually find that their application has been exclusively commended in cases likely to be influenced by the powers of faith or of the imagination; but, on the contrary, that they have frequently been directed in affections entirely beyond the control of the mind. Homer tells us, for instance, that the bleeding of Ulysses was stopped by a charm;* and Cato, the

* This superstitious practice is not confined to the ancients, but is even cherished to this day, in some of the more remote districts of the kingdom; and we find frequent allusions to it in the popular poetry of the seventeenth century.

"Tom Pots was but a serving man,
But yet he was a doctor good;
He bound his 'kerchief on the wound,
And *with some kind words* he staunch'd the blood."

Sir Walter Scott, in his "Lay of the last Minstrel"—

"She drew the splinter from the wound,
And with a *charm* she staunch'd the blood."

censor, has favoured us with an incantation for the reduction of a dislocated limb. In certain cases, however, we are unquestionably bound to admit that the pagan priesthood, with their characteristic cunning, were careful to perform their superstitious incantations, in such cases only as were likely to receive the sanative assistance of Nature, so that they might attribute the fortunate results of her efforts to the potent influence of their own arts. The extraordinary success which is said to have attended various superstitious ceremonials will thus find a plausible explanation. The miraculous gift attributed by Herodotus to the priestesses of Helen, is one amongst many others of this kind that might be adduced: the Grecian historian relates, that when the heads of ugly infants were adjusted on the altar of this temple, the individuals so treated acquired comeliness, and even beauty, as they advanced in growth: but is not such a change the ordinary and unassisted result of natural developement? Those large and prominent outlines which impart an unpleasing physiognomy to the infant, when proportioned and matured by growth, will generally assume features of intelligence in the adult face.

I shall conclude these observations by remarking that, in the history of religious ceremonials, we sometimes discover that they were intended to preserve useful customs, or to conceal important truths, which, had they not been thus *embalmed* by superstition, could never have been perpetuated for the use and advantage of posterity. I shall illustrate this fact by one or two examples. Whenever the ancients proposed to build a town, or to pitch a camp, a sacrifice was offered to the gods, and the soothsayers declared, *from the appearance of the entrails*, whether they were propitious or not to the design. What

The reader will also find the enumeration of several charms for this purpose, in Reginald Scot's Discoverie of Witchcraft, p. 273.

We learn also from Sennertus, that the older surgeons had recourse to prayers and magic for the extraction of foreign bodies from wounds. A very interesting summary of their superstitions, and peculiar notions concerning wounds, will be found in this author, under the head "De rebus alienise vulnere eximendis," Lib. v. Pars iv. Practicæ Medicinæ.

was this but a physiological inquiry into the salubrity of the situation, and the purity of the waters that supplied it? for we well know that in unwholesome districts, especially when swampy, the cattle will uniformly present an appearance of disease in the viscera, which an experienced eye can readily detect; and when we reflect upon the age and climate in which such ceremonies were performed, we cannot but believe their introduction was suggested upon principles of wise and useful policy. In the same manner, *bathing*, which at one period of the world was essentially necessary to prevent the diffusion of leprosy and other infectious diseases, was wisely converted into an act of religion, and the priests persuaded the people that they could only obtain absolution on washing away their sins by frequent ablutions;* but since the use of linen has become general, and every one has provided for the cleanliness of his own person, the frequent bath has ceased to be so essential; and therefore no evil has arisen from the change of religious belief respecting its connexion with the welfare and purity of the soul. Among the religious impurities and rules of purification of the Hindoos, we shall be able to discern the same principle, although distorted by the grossest superstition. So again, it is easy to perceive that the dangers consequent upon vinous inebriation in a hot climate, suggested the Mahometan prohibition of wine.

The ancient custom of erecting "*Acerræ*," or altars, near the bed of the deceased, in order that his friends might daily *burn incense* until his burial, was long practised by the Romans. The Chinese observe a similar custom; they place upon the altar thus erected an image of the dead person, to which every one who approaches it bows four times, and offers oblations and *perfumes*. Can there be any difficulty in recognising in this tribute to the dead a wise provision for the preservation of the living? The original intention, beyond doubt, being to

* So important was this act in the climates of Asia and Africa, that the Mahometan, if unable to obtain water in the desert, was directed to cleanse his person by frictions with the sand.

overcome any offensive smell, and to obviate any danger that might arise from the emanations of the corpse. But in order that the universality, as well as the antiquity, of the policy of making religious ceremonials subservient to secular purposes may be more satisfactorily established, I will adduce an illustration afforded by the superstitions of an uncivilized race of modern times. The pearl-diver in the Indian fisheries is constantly exposed, during his dangerous occupation, to the attack of the *ground shark*, a common and terrible inhabitant of all the seas in those latitudes. In order to avoid falling in with this foe, the adventurous Indian seeks for safety in supernatural means. Before he begins to dive, the priest, or conjuror, or, as he is termed in the Malabar language, the *Pillal Karras*, or *Binder of Sharks*, is always consulted, whose directions upon these occasions are received with confidence, and followed with the most implicit obedience. The advice which is given him, under the imposing weight of a religious ordinance, has for its sole object the maintenance of the health of the diver, and the adaptation of his body for the arduous occupation in which he is engaged: and it is not a little curious to observe that, in the performance of this duty, the *Pillal Karras* appears to display a judgment which the most enlightened views of modern science could not improve. The diver, for instance, is enjoined to abstain from all food for some time previous to his descent; and the experiments of Spalding, and others, have sufficiently demonstrated the fact, that the demand for oxygen in the lungs is materially increased by the presence of food in the body.

CREDULITY.

Although credulity differs very widely from superstition, yet in some respects it is nearly allied to it, and is not unfrequently so mixed up with it as to make it difficult to separate,

or even to distinguish one from the other. Credulity may be defined an unbounded belief in what is possible, although destitute of proof, and even of probability; whereas, superstition is a belief in what is wholly repugnant to the laws of the physical and moral world, and yet supposed to be attainable through supernatural agency. Thus, if we believe that an inert plant possesses any remedial power we are *credulous;* but if we were to fancy that, by carrying it about with us, we should become invulnerable, we should in that case be *superstitious.* The celebrated Boyle, when he recommended the thigh bone of an executed criminal as a powerful remedy in dysentery, was superstitious. Sir Theodore Mayerne, known to commentators as the Doctor Caius of Shakspeare, and who, by his personal authority, put an end to the distinctions of chemical and galenical practice in England, may be said to have displayed both superstition and credulity in his catalogue of remedies; such as the secundines of a woman in her first labour with a male child; the bowels of a mole cut open alive; mummy made of the lungs of a man who had died a violent death, &c. Celsus extols the efficacy of the warm blood of a recently slain gladiator, or a certain portion of human or horse flesh, in the cure of epilepsy. If he believed that such substances really possessed medicinal power he was *credulous;* but if he regarded them as charms, he was superstitious. He might possibly have recommended them as objects of disgust*

* It must be acknowledged that revolting applications have frequently produced benefit by a physical operation; we need only mention the nauseous remedies recommended by many writers on midwifery to expedite delivery, which induced the desired effect by producing nausea or vomiting. Hartman says, (*Opera, Fol.* p. 72,) that he has often witnessed amongst the poor, that difficult labour has been accelerated by a draught of the husband's urine, and he adds, that horse-dung infused in wine is efficacious in expelling the placenta. Sarah Stone, who published some cases in 1737, mentions several instances of women in labour, to whom was given the juice of leeks, mixed with their husband's urine, in order to strengthen the pains. Nauseous remedies have always enjoyed the confidence of the vulgar, and the prejudice would seem to be the result of a species of false reasoning by no means uncommon, that as everything

to excite a salutary horror; if so, the practice was not irrational. We find, indeed, that some of these remedies were successfully administered by Kaw Boerhaave, in the cure of epileptics, in the poor-house at Haerlem.

Credulity is a far greater source of error than superstition, for the latter must always be more limited in its influence, and can exist only, to any considerable extent, among the most ignorant portion of society; whereas the former diffuses itself through the minds of all classes, by which the rank and dignity of science are degraded, its valuable labours confounded with the vain pretensions of empiricism, and ignorance is enabled to claim for itself the prescriptive right of delivering oracles, amidst all the trumphs of truth and the progress of philosophy. This is very lamentable, and yet, were it even possible to remove the film that thus obscures the public discernment, such facilities does it afford to indolence, that I almost fear the plan would be outvoted by our own profession. In Chili, says Zimmermann, the physicians blow around the beds of their patients to drive away diseases; and as the people in that country believe that physic consists wholly in the wind, their doctors would take it very ill of any person who should attempt to make the method of cure more difficult; *they think that they know enough when they know how to blow.*

But this public imbecility is not characteristic of any particular age or nation. England has indeed, by a late continental writer,* been accused of possessing a larger share of credulity than its neighbours, and it has been emphatically called "*The Paradise of Quacks,*" but with as little truth as candour. Those rapacious depredators are not of one place, or of one season — they are the "*Perennials of History,*" and there is not a nation which has not been infested and disgraced by them; nor an age in which the patronage of the aristocracy has not been at their disposal. Rank and opulence

that is medicinal is nauseous, so must everything that is nauseous be consequently medicinal.

* A Tour through England, by Dr. Nemnich of Hamburgh.

have ever been ready to provide a sanctuary in which ignorant pretenders might enshrine themselves. If we refer to the works of Ætius, written more than one thousand three hundred years ago, we shall discover the existence of a similar infirmity with regard to physic. This author has collected a multitude of receipts, particularly those that had been celebrated, or used as *nostrums*,* many of which he mentions with no other view than to expose their folly, and to inform us at what an extravagant price they were purchased. We accordingly learn from him that the *collyrium* of Danaus was sold at Constantinople for one hundred and twenty numismata, (equal to about nine pounds,) and the cholical antidote of Nicostratus for two talents; in short, we shall find an unbounded credulity with respect to the power of inert remedies from the elixir and *Alkahest* of Paracelsus and Van Helmont, to the tar water of Bishop Berkley; the metallic tractors of Perkins, the animal magnetism of Miss Prescott and her disciples, and to the homœopathic granules of Hanhemann and Co. The portrait of Thessalus, the Roman empiric in the reign of Nero, as drawn by Galen, represents with equal force and fidelity the charlatan of the present day; and we cannot fail to recognise in Asclepiades of Bithynia, a resemblance to more than one popular practitioner of our own times. If we examine the writings of Scribonius Largus, who flourished in the reign of Claudius, we shall obtain ample evidence that the same ungenerous selfishness of keeping medicines secret, prevailed in ancient no less than in modern times; while we have only to read the sacred orations of Aristides, to be satisfied that the flagrant conduct of the Asclepiades, from which he so severely suffered,† was the very prototype of the cruel and remorseless

* *Nostrum* (our own,) a word very significant of the characteristic attribute of quackery.

† Aristides was the dupe and victim of the Asclepiades for ten successive years; he was alternately purged, vomited, and blistered; made to walk bare-footed, under a burning sun in summer, and in winter he was doomed to seek for the return of health, by bathing his feeble and emaciated body in the river. All this severity, he was made to believe, was

frauds, so wickedly practised by the unprincipled quacks, and advertising "*medical boards*," of our own times: and I challenge the apologist of ancient purity to produce a more glaring instance of empirical knavery and success in the annals of the nineteenth century, than that of the sacred impostor described in the Alexander of Lucian, who established himself in the deserted temple of Esculapius, and entrapped in his snares some of the most eminent of the Roman senators.

It is true, that in medical quackery, as in every other species of fraud, the knave may accomplish his object with greater or less ingenuity. The quackery of the present day is, perhaps, characterised by an artful plausibility, by an insidious appearance of candour, and by even a counterfeited air of science; for, although we may perchance meet with a remorseless ruffian who complacently smiles over the blood-stained victim whom he has plundered and murdered, the majority of empirics, like Gibbet in the Beaux Stratagem, "pique themselves on being the best behaved men *on the road*, and on conducting themselves with mercy in their vocation."

SCEPTICISM.

Credulity has been justly defined *belief without reason.* Scepticism is its opposite, *reason without belief*, and is the natural and invariable consequence of credulity; for it may be generally observed, that men who believe without reason, are succeeded by others whom no reasoning can convince; a fact which has occasioned many extraordinary and violent revolu-

exercised towards him by the express directions of Esculapius himself, with whom he was persuaded to fancy that he conversed in his dreams, and frequently beheld in nocturnal visions. Upon one occasion, the god, fatigued with the importunities of his votary, ordered him to lose one hundred and twenty pounds of blood; the unhappy man not having so much in his body, *wisely* took the liberty of interpreting the oracle in his own way, and parted with no more than he could conveniently spare.

tions in the *Materia Medica*, and will explain the otherwise unaccountable rise and fall of many useless, as well as important articles. It will also suggest to the reflecting practitioner a caution of great moment—to avoid the dangerous fault imputed to Galen by Dioscorides, that of ascribing too many and too great virtues to one and the same medicine. *By bestowing unworthy and exaggerated praise upon a remedy, we in reality do but damage its reputation, and run the risk of banishing it from practice;* for, when the sober practitioner discovers by experience that a medicine falls so far short of the efficacy ascribed to it, he abandons its use in disgust, and is even unwilling to concede to it that degree of merit, to which in truth and justice it may be entitled; the inflated eulogiums bestowed upon the operation of *digitalis* in pulmonary diseases, excited for a time a very unfair impression against its use. It is also well known with what earnestness the profession regarded the expectations raised by Stöerk of Vienna, in 1760, with regard to the efficacy of *hemlock;* "Everybody," says Dr. Fothergill, "made the extract, and everybody prescribed it; but finding that it would not perform the wonders ascribed to it, and that a multitude of discordant diseases refused to yield, as it was asserted they would, to its narcotic powers, practitioners fell into the opposite extreme, and declaring that it could do nothing, dismissed it at once, as inert and useless." In the earlier editions of this work, I predicted the fate of the *cubebs*, which had been restored to notice with such extravagant praise and unqualified approbation; who now places any confidence in the specific powers of that substance in the cure of the disease for which it was considered a never-failing remedy? May the advocates for the virtues of iodine, and of other more recently introduced remedies, derive a useful lesson of practical caution from these precepts.

As we are investigating the follies of physic, it will not be foreign to the subject, to observe that the above remarks may, with as much truth and force, be applied to medical writings,

as to medical substances; nothing is more fatal to the permanent character of an author than the extravagant and unmerited encomiums of the reviewer—superlatives lavished on inferior claims. It would be invidious to exemplify this truth, or we might adduce some striking instances where the inappropriate wreath has strangled the object which it was intended to adorn. Nor is it in medicine alone that such a reversal of judgment is brought about by exaggeration. Books have been written,* to prove most clearly that we are destroyed by our bread, drugged to death in our beer, poisoned in our water; in short, that we must, or ought to be, in the eye of reason, all dead and buried; and yet are we walking about, prosecuting our business or pleasure, just as though we were alive and healthy. Now, mark the mischievous tendency of such a system of exaggeration; by attempting to prove too much, we not only fail in accomplishing a little even of what we desire, but we unwittingly become the advocates of the very abuses we are anxious to correct: while we strengthen the cause of those whose delight is to disparage science, by forming antitheses of what they please to call *theory* and *practice*, and thus to cherish a spirit of scepticism with regard to the practical utility of science. I offer these observations in the spirit of friendly remonstrance, from an earnest desire to warn the junior members of our profession from a practice which deprives experience of its just value, and breaks down the barrier which ought to separate well-ascertained truths from the wild speculations of fancy.

Scepticism may also depend upon a condition of mind naturally produced by a particular and exclusive line of education. Those, for example, who have made mathematics their sole object of study, will not readily receive, without distrust, any evidence short of actual demonstration.

There are, moreover, those who cherish a spirit of scepticism from an idea that it denotes the exercise of a superior intellect. It must be admitted, that at that period in the history of Europe,

* Ex. Gr. "Death in the Pot."

when reason began to throw off the yoke of authority, it required superiority of understanding, as well as intrepidity of conduct, to resist the powers of that superstition which had so long held it in captivity; but in the present age, observes Mr. Dugald Stewart, "unlimited scepticism is as much the child of imbecility as implicit credulity."

FALSE THEORIES, AND ABSURD CONCEITS.

He who is governed by preconceived opinions may be compared to a spectator who views the surrounding objects through coloured glasses, each assuming a tinge similar to that of the glass employed;* or to borrow a striking illustration from Sir J. Herschel, who, taking iron as his subject, observes, that "while the vulgar regard it as actually fire-proof, the chemist acknowledges it as one of the most combustible bodies in nature. The poet uses it as an emblem of rigidity, but the smith and engineer, in whose hands it is plastic, and moulded like wax into every form,

* How facetiously has this universal tendency of the human mind to view every subject through the medium of its own predilections, been exemplified in the character of Osbaldiston's clerk in Rob Roy! The accountant is even made to reduce the great rule of moral conduct to arithmetical computation. "Thus," says he, "let A do to B as he would have B do to him; the product will give the rule of conduct required." It has been said that there is nothing, however extravagant, in fiction, that has not been equalled in real life; and it is to be feared that the history of physic would go far to support the allegation. If Osbaldiston's clerk be a caricature, what shall we say of the mechanical physicians who attempted to adjust the doses of medicines according to the constitution, by a mathematical rule, thus—they say "the *doses are as the squares of the constitution*;" and in the Edinburgh Medical Essays, there is actually a formal attempt to correct the errors of this rule. Alkahendi, a contemporary of Serapion in the ninth century, first applied the rules of geometrical proportion and of musical harmony to regulate the doses of medicine.

entertain a very different idea of its nature; the jailor prizes it only as an obstruction, while the electrician sees in it only a channel of communication, by which the air may be traversed by his imprisoned fluid." In like manner we might adduce the various pathological systems of different ages, and show that they have constantly borne the impress of the prevailing science of the day, and that in all their changes and modifications, cameleon-like, they have faithfully reflected the hue and colouring of the ascendant philosophy. In the present day, all the collateral sciences may be said to be cultivated by the physiologist and physician, without any injurious predilections; and this happy union, or "*mutual fecundation*," as Cuvier expresses it, has not only produced a swarm of new facts, but as every science is equally regarded, it prevents our remaining the slaves of any particular branch.

It may be readily shown that crowds of inert and insignificant drugs have been indebted for an ephemeral popularity to the prevalence of a false and engrossing theory. The celebrated hypothesis of Galen respecting the virtues and operation of medicines, may serve as an example; it is a web of philosophical fiction which has been rarely surpassed in absurdity. Adopting the theory of Hippocrates with regard to the four elements, he conceives the properties of all medicines to be derived from what he calls their elementary or *cardinal* qualities—Heat, Cold, Moisture, and Dryness. Each of these qualities he supposes is subdivided into four degrees, and a plant or medicine, according to this ideal assumption, is either cold or hot, in the first, second, third, or fourth gradation. If the disease to be treated be hot or cold in any of these four stages, a medicine possessed of a contrary quantity, and in the same proportionate degree of elementary heat or cold, must be selected as its remedy. Saltness, bitterness, and acridness, depend, in his idea, upon the relative degrees of heat and dryness in different bodies. It will be easily seen how a belief in such a fancy must have

multiplied the list of inert articles in the Materia Medica, and have corrupted the whole practice of physic. From this source, we may trace the introduction of an extensive list of different seeds into practice; and within a few years medical writers, in the true jargon of Galen, descanted upon the virtues of the *four* greater and lesser *hot* and *cold* seeds; and in the London Dispensatory of 1721, we find the powders of *hot* and *cold* compound powders of pearl. Several of the ancient combinations of opium, with various aromatics, are also indebted to Galen for their origin, and to the blind adherence to his authority for their lasting reputation; for he asserted that opium was *cold in the fourth degree*, and must therefore require some corresponding *hot* medicine to moderate its frigidity. The Edinburgh College, in the last edition of their Pharmacopœia, have omitted the *Jamaica pepper* in the *pilulæ opiatæ*, which evidently owed its origin to the Galenist.

The Methodic Sect, founded by the Roman physician Themison, a disciple of Asclepiades of Bithynia, and, like his master, of the school of Epicurus, rejected the doctrine of the four humours, and regarded the solids as the only seats of disease; and as they conceived every disorder to depend upon *constriction* or *relaxation*, so did they class all medicines under the head of *relaxing* or *bracing* remedies; and although this theory has been ages ago banished from the schools, it still continues to exert a certain secret influence on medical opinions; the general belief, for instance, in the *relaxing* effect of the *warm*, and the equally *bracing* influence of the *cold* bath, may be traced to conclusions deduced from the operations of hot and cold water upon parchment and other inert bodies,* while several medicines in present use may be readily recognised as the legacies of this defunct philosophy.

But amongst all the systems that have produced important changes in the Materia Medica, we may rank the two great rival sects of chemists and mathematicians as the most con-

* See "An Experimental Enquiry into the Effects of Tonics and other Medicines on the Cohesion of the Animal Fibre," by Dr Crawford.

siderable. The rapid advancement of mathematical science during the latter part of the sixteenth century, and the success with which it was applied to various branches of philosophy, naturally led to its introduction into the practice of physic; and hence the "*Intro-mathematical*" school. Every phenomenon in the living body, and every remedy for the correction of its disorders, were referred to a mechanical cause; "*lentor and morbid viscidity of the blood*" were recognised as the principal cause of all diseases, and attenuant and diluent medicines, or substances endued with some mechanical force, were considered as the universal remedies; thus, Fourcroy explained the operation of mercury by its specific gravity;* and the advocates of this doctrine favoured the general introduction of the preparation of iron, especially in schirrus of the spleen or liver, upon the same hypothetical principle; for, say they, whatever is most forcible in removing the obstruction, must be the most proper instrument of cure; such is *steel*, which, besides the attenuating power with which it is furnished, has still a greater force in this case from the *gravity* of its particles, which, being seven times specifically heavier than any vegetable, acts in proportion with a stronger impulse, and therefore is a more powerful *deobstruent*. This may be taken as a fair specimen of the style in which the mechanical physicians reasoned and practised. The same hypothetical views led them to certain conclusions regarding the mechanical state of the blood in disease, and suggested the frequent use of the lancet. Dr. Mead, in his "*Mechanical Account of Poisons*," has some very amusing speculations to account for the effect of the venom of the viper. Upon ex-

* Van Swieten, in his Commentaries on the Venereal Disease, has an aphorism founded on the same hypothesis; "Render the blood and lymph more fluid, and you will have destroyed the virus." Sect. 1447. In the first volume of the Transactions of the College of Physicians, there is a paper to the same effect, entitled, "On the Operation of Mercury in different Diseases and Constitutions," by Edward Barry, M.D., F.R.S., read at the College, July 12, 1767.

amining the poison with a microscope, he observed " a number of saline particles shot out, as it were, with crystals of an incredible tenuity and sharpness; and so rigid were these *spicula* or *darts*, that they remained unaltered for several months." He adds, " These acute salts, when mingled with the blood, do prick the globules, and so let out their imprisoned active substance." He refers the operation of opium to a volatile salt which " expands and makes a disjunction and rarefication of the blood, which, by distending the vessels of the brain, does lessen the influx of the nervous fluid by pressing upon the little *tubuli* or canals, through which it is derived." Locke observes, in his Essay on the Human Understanding, that " if we could discover the figure, size, texture, and motions of the minute constitutional parts of any two bodies, we should know, without trial, several of their operations one upon another, as we do now the properties of the square or a triangle. Did we know the mechanical affections of the particles of rhubarb, hemlock, opium, and a man, as a watchmaker does those of a watch, whereby it performs its operations, and of a file which, by rubbing on them, will alter the figure of any of the wheels, we should be able to tell beforehand that rhubarb will purge, hemlock kill, and opium make a man sleep."

The Chemists, as they acknowledged no source of disease but the presence of some hostile acid or alkali—some untoward fermentation of the fluids—or some deranged condition in the chemical composition of the body, so they conceived all remedies must act by producing some chemical change, but the influence of this science upon the Materia Medica, from the revival of learning to the present day, is too important to be hastily treated; I shall therefore devote a distinct section to its consideration, and shall only here observe that no branch of natural science, in its application to medicine, ever gave origin to more error, or conferred upon it more substantial service.

While medical opinion was balanced between the mathe-

maticians and chemists, from the ranks of the latter arose a master spirit, who, throwing off the shackle of authority, asserted that all the changes of the body were under the influence of a specific agent, which he called ARCHÆUS, and which he imagined to reside in, or to be in some way attached to, the living system; and, although this hypothesis produced but little influence upon the practice of medicine, it afterwards became the match to kindle a new light, which may be said to have thrown into obscurity the rival theories that were based upon the agencies of inert matter. Stahl, although the greatest chemist of the age, was soon convinced that neither his own science, nor that of mechanics, could in themselves furnish a clue to unravel the mysteries of vital action; he therefore imagined the existence of an immaterial animating principle, by the operation of which upon the organs of the body, he supposed all the vital functions to be produced. To this principle he gave the name *Anima;* and we are told that it superintends and directs every part of the animal economy from its first formation; that it prevents or repairs injuries, and counteracts the effects of morbid causes. In his investigations into the nature of this supposed principle, he undoubtedly led the way to a sounder physiology; but the effect of his theory upon the practice of physic was less fortunate; for, under the impression of this ideal system, remedies of the most inert and superstitious kind were introduced, while his disciples, as they on all occasions trusted to the constant attention and wisdom of this tutelary agent, so did they zealously oppose the use of some of the most efficacious instruments of art, as the *Peruvian bark*, &c., and few physicians were so reserved in the use of general remedies, as bleeding, vomiting, and the like; their practice was therefore imbecile, and it has aptly enough been denominated "*A Meditation upon Death.*" They were, however, vigilant in observation, and acute in discernment, and in these respects were worthy followers of Hippocrates; and although they may have retarded the progress of therapeutics, they as certainly have advanced the study of pathology.

Although I profess to offer merely a few illustrations of those prominent doctrines, whose applications have influenced the Materia Medica, I cannot pass over in silence that of John Brown, "*the child of genius and misfortune.*" As he generalized diseases, and brought all within the compass of two grand classes, those of *increased* and those of *diminished* excitement, so did he abridge our remedies, maintaining that every agent which could operate on the human body was a stimulant, having an identity of action, and differing only in the degree of its force; so that according to his views the lancet and the brandy-bottle were but the opposite extremes of one and the same class.

But the most absurd and preposterous hypothesis that has disgraced the annals of medicine, and bestowed medicinal reputation upon substances of no intrinsic worth, is that of the "DOCTRINE OF SIGNATURES," as it has been called, which is no less than a belief that *every natural substance which possesses any medicinal virtues, indicates, by an obvious and well-marked external character, the disease for which it is a remedy, or the object for which it should be employed.** This extraordinary monster of the fancy has been principally adopted and cherished by Paracelsus, Baptista Porta, and Crollius, although traces of its existence may certainly be discovered in very ancient authors. The root of the *mandrake*, from its supposed resemblance to the human form, was esteemed as a remedy for sterility: thus, did Rachel demand from her sister the mandrakes (*dudaim*) which Reuben had gathered in the field; impressed, as it would appear, with a belief in the efficacy of that plant against barrenness. (*Genesis* xxx. 14.) There would moreover, in this case, seem to have been some idea of additional virtue arising from the person who gathered it, for great stress was laid upon this circumstance, "*my son's* mandrakes;" such a notion is by no means uncommon in the his-

* This conceit did not escape the notice of the metaphysical poets of the seventeenth century. Cowley frequently availed himself of it to embellish his verse.

tory of charms. The supposed virtues of the *Lapis Ætites*,* or eagle-stone, described by Dioscorides, Ætius, and Pliny, who assert that if tied to the arm it will prevent abortion, and if fixed to the thigh, forward delivery, were, as we learn from ancient authority, solely suggested by the manner in which the nodule contained within the stone moves and rattles whenever it is shaken—"*Ætites lapis agitatus sonitum edit, velut ex altero lapide prægnans.*" The conceit, however, did not assume the importance of a theory until the end of the fourteenth century, at which period we find several authors engaged in the support of its truth, and it will not be unamusing to offer a specimen of their sophistry; they affirm that, since man is the lord of the creation, all other creatures are designed for his use, and *therefore* that their beneficial qualities and excellencies must be expressed by such characters as can be seen and understood by every one; and as man discovers his reason by speech, and brutes their sensations by various sounds, motions, and gestures, so the vast variety and diversity of figures, colours, and consistencies, observable in inanimate creatures, is certainly designed for some wise purpose. It *must be*, in order to manifest those peculiar properties and excellencies, which could not be so effectually done in any other way, not even by speech, since no language is universal. Thus, the lungs of a fox *must* be a specific for asthma, *because* that animal is remarkable for its strong powers of respiration. *Turmerick* has a brilliant yellow colour, which indicates that it has the power of curing jaundice; by the same rule, *Poppies* must relieve diseases of the head; *Agaricus*, those of the bladder; *Cassia Fistula*, the affections of the intestines; and *Aristolochia*, the disorders of the uterus. The polished surface and stony hardness which so eminently characterise the seeds of the *Lithospermum officinale*, (common Gromwell,) were deemed a certain indication of their efficacy in calculous and gravelly disorders; for the same reason the roots of the *Saxifraga Granulata*,

* This mineral derives its names from the ancient belief that it was found in the nest of the eagle. It is a variety of iron ore.

(white saxifrage) gained reputation in the cure of similar diseases; and the *Euphrasia* (eye-bright) acquired fame as an application in complaints of the eye, because it exhibits a black spot in its corolla resembling the pupil. In the curious work of *Chrysostom Magnenus*, (Exercit. de Tabaco,) we meet with a whimsical account of the *signature* of tobacco. "In the first place," says he, "the manner in which the flowers adhere to the head of the plant indicates the *infundibulum cerebri*, and *pituitary gland;* in the next place, the three membranes, of which its leaves are composed, announce their value to the stomach, which has three membranes."*

The blood-stone, the *heliotropium* of the ancients, from the occasional small specks or points of a blood-red colour exhibited on its green surface, is even at this day employed in many parts of England and Scotland to stop a bleeding from the nose; and nettle-tea continues a popular remedy for *urticaria*. The powder occasionally found within the cavity of flints is still used in our chalk countries as a remedy in calculous complaints. Dr. Beddoes mentions a case of this kind which occurred within his own knowledge, but he observes that the idea was probably conceived on the supposition that one kind of grit would draw or drive the other out of the body;—"Clavum Clavo"—if so, Hahnemann has been anticipated—but more of this anon.

It is also asserted that some substances bear the SIGNATURES of the humours, as the petals of the red rose that of the blood, and the roots of rhubarb, and the flowers of saffron, that of the bile.†

I apprehend that John of Gaddesden, in the fourteenth century, celebrated by Chaucer, must have been directed by some remote analogy of this kind, when he ordered the son of Edward I., who was dangerously ill with the small-pox, to

* "Chrysost. Magneni Exercit. de Tabaco."

† For a further account of this conceit, see Crollius, in a work appended to his "BASILICA CHYMICA," entitled "De Signaturis internis rerum, seu de vera et viva Anatomia majoris et minoris mundi."

be wrapped in scarlet cloth, as well as all those who attended upon him, or came into his presence; and even the bed and room in which he was laid were covered with the same drapery; and so completely did it answer, say the credulous historians of that day, that the prince was cured without having so much as a single mark left upon him.*

In enumerating the conceits relating to the Materia Medica, we must not omit the idea, so prevalent at one period, that *all poisonous substances possess a powerful and mutual elective attraction for each other;* and that consequently, if a substance of this kind were suspended around the neck, it would, by intercepting and absorbing every noxious particle, preserve the body from the virulence of contagious matter. Angelus Sala, accordingly, gives us a formula for what he terms his *magnes arsenicalis*, which he asserts will not only defend the body from the influence of poison, but will, from its powers of attraction, draw out the venom from the infected person. In the celebrated plague of London, we are informed that amulets of arsenic were, upon this principle, suspended over the region of the heart, as a preservative.

There is yet to be mentioned another conceit which long existed with respect to the subject of antidotes—a belief that every natural poison carried within itself its own antidote. Thus, we learn from the writings of Dioscorides, Galen, and Pliny, that the virus of the *cantharis vesicatoria* existed in the body of the fly, and that the head, feet, and wings, contained

* In a curious old work, entitled "Popular Errours in Physic, by the learned Physician James Primrose, London, are the following remarks: "That red cloths are not to bee preferred before others for the voyding of the measils. That in the measils and small pox the endeavours of nature, purging out the humours into the habit of the body, is to be assisted it is manifest by the verdict of physicians, and, seeing that nature itself teaches it, therefore every one, even the most ignorant amongst the people, knows it. Wherefore many doe use to cover the sick with red cloaths, for they are thought, by the *affinitie of the colour*, to draw the blood out to them; or, at least, some suppose that it is done by force of imagination; and not only the people, but also very many physicians, use them," &c.

its antidote; for the same potent reason were the hairs of a rabid dog esteemed the true specific for hydrophobia: and, in the second volume of the Hamburgh Medical Repository, may be found collected a number of striking cases, and various authorities, in proof of the specific power of the blood of a rabid animal in the cure of that disease. From the same notion, the fat of the viper was regarded as a remedy for its bite.*

It might have been expected that the impulse which the theory and practice of physic have of late years received from the purer spirit of philosophy, would have for ever carried it beyond the sphere of such blind prejudices and shallow paradoxes; it is therefore with feelings of humiliation that I proceed to notice that new-blown bubble which has been distinguished by the high-sounding title of the HOMOÖPATHIC SYSTEM, or the art of curing founded on *resemblances*, as its name expresses, (ὁμοῖον πάθος,) a system founded on the chimerical belief, that *every disease is curable by such medicines as would produce in a healthy person symptoms similar to those which characterise the given disease.* "SIMILIA SIMILIBUS CURENTUR"—a dogma which is directly opposed to the palliative system of Hippocrates, "CONTRARIA CONTRARIIS." (*Aphorism* 22, *Sect.* 2.)

It cannot be expected that I should do more than give an outline of this extraordinary system. Those who desire to penetrate further into its mysticism may consult the work of its founder,† or more readily an able article in No. C. of the Edinburgh Review. If the principle of Hahnemann be true, we must certainly admit with the author, that although

* In various black-letter works on Demonology, we are assured that three scruples of the ashes of the witch, when she has been *well and carefully burnt* at a stake, is a sure catholicon against all the evil effects of witchcraft. The author of Waverley alludes to this superstition in his ABBOT.

† Organon des Heilkunst von Samuel Hahnemann, Fourth Edition, Dresden and Leipsic, 8vo. 1820.

for thousands of years it may have escaped recognition, still it must have left in every age visible traces of its occasional developement. It was therefore natural for Hahnemann, after he had accidentally found that bark, which cures intermittents, produced in his own frame aguish symptoms, to search for analogous cases amongst the various medical authorities of ancient and modern times. Forty pages of citation, observes the author of the review above alluded to, demonstrate that the search was not made in vain. A short account of the most remarkable of these cases will probably be the easiest mode of putting the reader in full possession of the pith and marrow of the homœopathic doctrine. Thus, the author of the fifth book, Επιδημιῶν, describes an Athenian attacked by the most violent *cholera*, as cured by hellebore, which is, in itself, so violently emetic and cathartic as to produce a kind of cholera. Again, the English sweating sickness, which appeared for the first time in 1485, and was of so destructive a character as to kill nine-tenths of those attacked with it, could not be allayed until the use of *sudorifics* was resorted to. In like manner, Fritze and De Haen saw convulsions and delirium produced by a species of nightshade, and the latter physician, by aid of small doses of the same poison, effected the cure of similar convulsions. From learned quotation Hahnemann descends to common experience. He asks whether we do not apply snow or ice to a frozen limb—whether the cook does not expose a scalded hand to the fire, wisely despising the increased smart which this occasions, in the conviction that the pain and its cause will be removed by a few minutes of endurance? Others, he says, apply heated spirits of wine, or oil of turpentine, which work a cure in a few hours; whereas cooling salves might be used in vain for as many months, while cold water would only aggravate the mischief. And here the culinary empiric has the support of mighty names. Fernelius (*Therap.* l. vi. c. 20) recommends us to bring the burnt part to the fire. John Hunter condemns the use of cold water, and approves of exposure to heat.

Sydenham and Benjamin Bell declare for spirits of wine, and Kentish, Heister, and John Bell applaud the use of turpentine. It is from such facts, backed by such authorities, that he takes his stand; and in the deep conviction of the truth of his principle, and the importance of his discovery, he triumphantly exclaims, "Yes! there were, from time to time, physicians who surmised the important truth, that medicines healed disease only through their fitness for exciting analogous symptoms." But enough of his *principle*—let us now examine the mode of its application. It will be readily perceived that the homœopathist can have no other object than to deal with the symptoms; he does not inquire whether the patient has a fever, or a fit of the gout, or a disease in the brain, liver, or lungs, but he makes curious inquiries as to the state of the skin, his joints, or his great toe. Since these symptoms are the great object of attack, and since, according to his doctrine, every collection of them must be cured by something which would excite analogous affections in a healthy subject, the nature of a homœopathic pharmacopœia may be readily imagined. It may, perhaps, be asked how the tendencies of different medicaments to produce particular symptoms can be ascertained?—by experience. "A set of meek and much-enduring men, of sound constitutions, must be found ready to submit their own bodies to the useful but unpleasing task of serving as pharmaceutical tests." But the most absurd and startling part of the story, and that which will assuredly give the rudest shock to the reader's credulity, yet remains to be told: it is the marvellous exiguity of the doses which are required for producing the desired effect—a dose which the English practitioner might give to a suckling would, in the hands of a disciple of Hahnemann, be sufficient to cure the inhabitants of a whole solar system! The millionth part of a grain of many substances is an ordinary dose; but the reduction proceeds to the *billionth*, *trillionth*, nay, even to the *decillionth* portion of a grain! Now let us ask whether it has ever occurred to the reader to ima-

gine a quantity represented by a decillion? if not, we will enlighten him upon this point. Suppose, then, that every inhabitant upon the face of the globe were to take this homœopathic dose every second of time, six thousand years must elapse before a single grain could be consumed! But, it will be asked, how can so minute a division be practically effected? This question will be most readily answered by giving a specimen of their formulæ. "Supposing the medicine to belong to the mineral kingdom, one grain of it, if possible in a pulverized form, is to be mixed with ninety-nine grains of sugar of milk, by rubbing them together in a glass or stone mortar for the space of an hour. Of this mixture one grain is in like manner to be rubbed with ninety-nine grains of sugar of milk, so that each grain of this second composition contains only one ten-thousandth part of the original grain of medicine. A third trituration will bring the proportion down to one millionth, a sixth to one billionth, and so on. In the preparation of mercury, one grain of pure running quicksilver is reduced in this manner to the millionth degree; a single grain of the powder thus obtained is then dissolved in ninety-nine drops of diluted spirits of wine; one drop of which solution is again shaken together with ninety-nine drops of the vinous spirit; and another repetition of this process having reduced the mixture to the billionth degree, a few sugar pellets, of the size of poppy seeds, are moistened with this liquid, whereof two or three constitute a dose! But the deglutition of even these minute particles is not esteemed always needful; in some instances it is only necessary to smell the phial in which the pellets are enclosed. Now the reader will be curious to hear what the homœopathist can possibly adduce in support of so strange a vagary of the imagination, he shall therefore, in a few words, be informed of the process of reasoning by which the value of infinitesimal doses is sought to be established. "Since, in the treatment of disease, medicines calculated to produce similar effects are alone to be used, these medicines will have to work upon an orga-

nization already predisposed to be affected by them; and the power of medicine being at any rate more energetic than that of natural sickness, a *very small quantity* of medicine must be adequate to act upon an organization thus prepared. The slightest aggravation of the disease by medical means will constitute an artificial malady powerful enough to control and suppress the natural one; and the more slight this artificial malady, the more easily will it, in its turn, give way to the vital principle." In the next place, Hahnemann contends that the *rubbing* and *shaking* to which the preparations are subjected, not only alter, but develope, in a manner hitherto unknown, the powers of the drugs so treated: so that it is upon the augmented force of the medicines, however reduced in bulk, which results from his method of preparing them, that the founder of this strange system seems inclined to rest his explanation.

That amongst the credulous public a train of knight-errants should be found to enter the lists against science and common sense is not so extraordinary; but that any professional man of ordinary education and honesty should present himself as the defender of a doctrine that contradicts all facts, and confounds all opinions, is wholly unaccountable. "But cures have been performed through its means;"—true—but on whom? On hypochondriacs who have been drenched for years with physic, and to whom this system has brought a truce, while it has encouraged their faith through the medium of the imagination.

If it were necessary to enter upon a serious refutation of this doctrine, we might, in the first place, observe, that symptoms, apparently similar, arise from the most opposite conditions of disease—witness, for instance, those connected with disturbance of the digestive and cerebral organs. Then, with regard to the *facts* upon which this doctrine is founded; who ever heard of *quina* producing ague, or colchicum the gout? All experience disproves these data; some of the members of the *Académie de Médecine* have fairly put them to the test.

Andral tried the system on one hundred and thirty patients, in the presence of the homœopathists themselves, adopting every care and precaution, yet in not one instance was he successful; in short, by what stretch of ingenuity or compass of belief can any rational person be brought to the conviction that a portion of matter so infinitely small can ever affect the human frame; or, supposing that possible, how can we admit that the remedies proposed are appropriate to the diseases?

"Malum quod minimum est, id minimum est malum."

In the foregoing sketch my object has not been to furnish anything like a connected history, but to point out such prominent doctrines as may have retarded or accelerated our knowledge of medicinal substances. To us, enlightened as we are in the present day by the highly advanced state of the various collateral branches of science, we cannot but feel surprised that hypotheses, so extraordinary and apparently absurd, should connect themselves with names which we have been taught to revere as the luminaries of physic; but though history may thus throw into prominent relief the errors of the past, it will no less point out examples of wisdom, and enable us to draw lessons of instruction from its stores; we shall find, for instance, that the wisest of those physicians, however they may have indulged in extravagant hypotheses, never allowed their speculations to vitiate their practice, or to divert them from the steady path of experience. The former must be attributed to the darkness of the age, the latter to the sound understanding and penetration of the individual. Hippocrates never suffered his theory of the humours to supersede his vigilant observation of facts. Aretæus was a disciple of the Pneumatics, (a branch from the Methodics,) but the medical scholar knows full well how to appreciate his unrivalled descriptions of disease.

Baglivi was a zealous partisan of the Iatro-mathematical school, but in practice he was a faithful follower of Hippocrates. Sydenham was a believer in the morbid fermentation

of the fluids, but he kept his theory in subjection to his experience, and was one of the wisest of practical physicians. Boerhaave was attached to the mechanical doctrine of Bellini, but who ever read his *Institutions* and his *Aphorisms*, who did not recognise in him the correct observer and sagacious practitioner? Theory can no more mislead such practitioners, than the *Will o' the whisp* can seduce the traveller who carries a lighted torch. Thus, then, the importance attached to the distinction between the dogmatist and empiric has no substantial foundation. It has been well observed, that "the boldest dogmatist professes to build his theory upon facts, and the strictest empiric cannot combine his facts without some aid from theory." Far otherwise, however, is it where, without the light of experience, or the talent for observation, the student deeply imbued with the speculations of the schools, enters upon the *practice* of physic; hence, in the hands of those whose theories have not been under the subjection of experience, have many of our more valuable remedies fallen into disrepute; the fame even of Peruvian bark has been occasionally obscured by the clouds of false theory; some have condemned its use altogether, "because it did not evacuate the morbific matter;" others, again, "because it only bound up the spirits, and stopped the paroxysms for a time, and favoured the translation of the peccant matter into the more noble parts;" thus, we learn from Morton,* that Oliver Cromwell fell a victim to an intermittent fever, because the physicians were too timid to make a trial of the bark. In the history of this medicine, it is a curious fact that it was first sold by the Jesuits for its weight of silver,† and that,

* Pyretologia, p. 17, A. D. 1692.

† Sturmius, in his "*Febrifugi Peruviani Vindiciæ*," published in 1658, observes that he saw twenty doses of the powder sold at Brussels for sixty florins, in order that it might be sent to Paris, and that he would willingly have become a purchaser of some doses even at that price, but the apothecary was unable to supply him;—an anecdote not more illustrative of the reputation of the bark, than of the honesty of the vender. This species of exchange, with regard to popular drugs, was not uncom-

according to Condamine, in 1690, about thirty years afterwards, several thousand pounds of it lay at Piura and Payta for want of a purchaser. Nor has sugar escaped the influence of hypothesis. Dr. Willis* raised a popular outcry against its domestic use, declaring that "it contained within its particles a secret acid—a dangerous sharpness, which caused scurvies, consumptions, and other dreadful diseases." Some chemical physicians regarded it as favourable to nutrition, since, in consequence of the property which it possesses of uniting oily and watery bodies, they thought it would enable the unctuous part of the food to unite with the animal juices; while others, on the contrary, deduced a very different inference, and supposed that, from this same property, sugar would prevent the separation of the oily part of the food, and thus counteract the process of nutrition. Had the voice of experience been heard, these theorists would soon have discovered that sugar is incapable of producing either the one or the other of these effects.

With regard to the more immediate object of the present work, I would advise the pharmacologist, in recording his experience, never to mix up speculations with the statement of observed facts. Without any intention to falsify his record, the practitioner too frequently distorts truth, unperceived even by himself, from the use of language which partakes of the colouring of false theory. It is this which has rendered the experience of many of our older writers on the nature of the Materia Medica worse than useless, and has converted what might otherwise have been a rich store of practical wisdom into a mass of error and confusion.

mon. According to Aubrey, tobacco was sold for its weight in silver, and "I have heard some of our old yeomen," he observes, "say that when they went to a Malmesbury or Chippenham market, they called out the biggest shillings that lay in the scale against the tobacco;" and Hamel says that, in the Korea, opium is bartered for in a similar manner.

* Dr. Willis first discovered the existence of sugar in diabetic urine.

In concluding our analysis of the revolutions of medical theories, with a view to convert their errors into lessons of instruction, there is a moral to be deduced from the history of their adoption and promulgation, too valuable to be left without a passing remark. In philosophy, as in politics, the partisans of a popular leader have ever been more sanguine and less reasonable than their master; they not only delude the world, but they appear anxious to deceive themselves; and while they warmly defend their favourite system from the attacks of those that may assail it, they willingly close their own eyes, and conceal from themselves the different points that may be weak and untenable; or, to borrow the figurative language of a French writer, they are like the pious children of Noah, who went backwards, that they might not see the nakedness which they approached to cover. If the departed spirits of the founders of political, religious, or philosophical sects, could by some necromantic power be recalled to justify their opinions, there would not be one of them that would not declare his disciples had far outstripped the boundaries of his creed.*

THE APPLICATION AND MISAPPLICATION OF CHEMICAL SCIENCE.

Amongst the researches of different authors who, animated with a sacred zeal for ancient learning, have endeavoured to establish the antiquity of chemical science, we find many conclusions deduced from an ingenious interpretation of the mythological fables† which are supposed to have been trans-

* When John Wilkes was rallied by the king for his apparent indifference to the cause of liberty, he assured his majesty that he never had been a WILKITE.

† We must admit that some of these allegories are too obvious to be

mitted by the Egyptians, who, previous to the invention of letters, adopted this method of perpetuating their discoveries in natural philosophy. Thus, wherever Homer studiously describes the stolen embraces of Mars and Venus, they recognise some chemical secret, some combination of iron with copper, shadowed in the glowing ornaments of fiction. Lord Bacon* conceived that the union of spirit and matter was allegorized in the fable of Proserpine being seized by Pluto as she was gathering flowers; an allusion, says Dr. Darwin, which is rendered more curiously exact by the late discovery, that pure air (*oxygen*) is given out by vegetables, and that in this state it is greedily absorbed by inflammable bodies. The same ingenious poet supposes that the fable of Jupiter and Juno, by whose union the vernal showers were said to be produced, was meant to portray the production of water by the combination of its two elements; "an opinion which," says he, "is strongly supported by the fact that, in the ancient mythology, the purer air, or *æther*, was always represented by Jupiter, and the inferior by Juno." Were the elegant author of the Botanic Garden now living, he would no doubt, with a taste and delicacy peculiarly his own, avail himself of the singular discovery of Mr. Smithson,† who has detected in the juice of the mulberry *two* distinct species of colouring matter; the mingled blood of the unfortunate Pyramus and Thisbe:

> "Signa tene cædis; pullosque et luctibus aptos
> Semper habe fætus, *gemina* monumenta cruoris."
> *Ovid. Metamorph. Lib.* iv. 160.

mistaken. Homer attributes the plague that prevailed in the Grecian camp to the darts of Apollo; what was meant by this, but that it arose from the action of a burning sun upon the marshes and slimy shores of Troas? and what, again, can be more obvious than the allegory by which Echo is made the daughter of air and earth?

* Bacon's works, vol. v. p. 470. 4th edit. London, 1778.

† This gentleman was an early friend of Dr. Wollaston, and like that distinguished philosopher, he delighted in microscopic analysis. Upon one occasion he caught the tear of a lady as it was trickling down her

Sir William Drummond, the learned apologist of Egyptian science, conceives that the laws of *latent* heat were even known to the philosophers of that ancient nation, and that caloric in such a state was symbolically represented by VULCAN, while *free* or *sensible* caloric was as clearly described in the character of VESTA. Those who maintain the antiquity of chemistry, and suppose that the fabulous conceptions of the ancients were but a mysterious veil ingeniously thrown by philosophy between nature and the lower order of people, consider that the alchemical secret is metaphorically concealed in the fable of the GOLDEN FLEECE of the Argonauts, and reject the more probable solution of this story by Strabo, who says, that the Iberians, near neighbours of the Colchians, used to receive the gold, brought down from the high lands by the torrents, into sieves and sheep-skins, and that from thence arose the fable of the golden fleece. Dionysius of Mitylene offers a different explanation of the fable, and supposes it to allude to a book *written on skins*, and containing an account of the process of *making gold* according to the art of alchemy.

Notwithstanding the confidence with which modern philosophers have claimed the discovery, the experimental mode of investigation was undoubtedly known and pursued by the ancients, who appear, says Mr. Leslie,* to have concealed their notions respecting it under the veil of allegory. *Proteus* signified the mutable and changing forms of material objects, and the inquisitive philosopher was counselled by the poets† to watch their slippery demon when slumbering on the shore, to bind him, and compel the reluctant captive to reveal his secrets. This, adds Mr. Leslie, gives a lively picture of the cautious but intrepid advances of the skilful experimenter; — he tries to press nature into a corner,—

cheek, and having submitted it to experiment, ascertained the presence of several saline bodies.

* Leslie's Elements of Natural Philosophy.

† Virg. Georg. iv. 392—402.

he endeavours to separate the different principles of action, —he seeks to concentrate the predominant agent, and labours to exclude, as much as possible, every disturbing influence.*

But with whatever ingenuity and success the antiquity of chemical knowledge may be advocated as it relates to the various arts of life, yet it must be allowed that not the most remote trace of its application to physic can be discovered in the medical writers of Greece or Rome. The operation of distillation† is not even mentioned by Hippocrates or Galen; and the waters of different plants, as described by some later authors, are to be understood, as we are informed by Gesner, merely as simple decoctions, and not as the products of any chemical process; while the essences of Dioscorides, Galen, Oribasius, and others, were only the extracts produced by the evaporation of such infusions.

Upon the downfall of the Roman empire, all the sciences, the arts, and literature, were overwhelmed in the general wreck, and the early Mahometans, in the first paroxysms of their fanaticism, endeavoured to destroy every record of the former progress of the human mind; consigning to destruction, by the conflagration of the Alexandrian library, no less than seven hundred thousand volumes, which comprised the most valuable works of science and literature.‡ It is not a little extraordinary that this same people were destined, at a

* Mr. Sankey also conceives, with much ingenuity, that this fable of Proteus expresses, allegorically, the difficulty of seizing upon elementary forms, as well as the infinity of combinations of which they are susceptible. Πρωτειος, he observes, being derived from πρωτος, signified the first principle or element.

† Dioscorides and Pliny describe a process which may be considered that of distillation in its infancy; it consists in obtaining oil from pitch, by spreading over it, while boiling, fleeces of wool, which receive the vapour, and afterwards yield it by expression. In this country the art of distillation was unknown at the time when the Romans had possession of it. It is said to have been introduced in the early part of Henry II.

‡ It was destroyed in the sixth century by the Caliph Omar, the cotemporary and companion of Mahomet.

more advanced period, to rekindle the light of letters* which they had taken such pains to extinguish, and to become the inventors and cultivators of a new science, boundless in its views, and inexhaustible in its applications. The medical profession, too, was more particularly selected as an object of reward and encouragement; and we may say, with much truth, that our *Materia Medica* is more indebted to the zeal and industry of the Arabians, than to the learning of the Greeks, or to the refinement of the Romans. From this source we have acquired the milder purges of *Manna*, *Cassia*, *Senna*, *Rhubarb*, and many plants and oriental aromatics, amongst which we may notice *Musk*, *Nutmeg*, *Mace*, and *Cloves;* the introduction of which into medicine was greatly facilitated by the situation of Bagdat, and its connexion with India; and although Archigenes and Aretæus had long before applied *Blisters*, yet it is to the Arabian physicians that we are indebted for a practical acquaintance with their value, for in general the Greeks and Romans prescribed acrid *Sinapisms* for such a purpose. We are also indebted to the Arabians for our knowledge respecting camphor, as its name imports, for the original word was *Cafur*, or *Canfur*.† They are also the first upon record, who speak of sugar and sugar-candy, extracted from the sugar-cane, which they call *honey of cane;* and they ushered into practice *Syrups*, *Juleps*, and *Conserves*. At the same time it is but just to allow, that from the disgusting ostentation of this people, and their strong attachment to the marvellous, many absurd medicines have been introduced. Gold, silver, bezoars, and precious stones, were received into the Materia Medica, and surprising virtues were attributed to them. Amongst a people thus disposed to mag-

* The Saracens, in their treaty with the Greek emperors, demanded, by express articles, the works of the ancients.

† Garcias, as well as Geoffroy and Hill, say that Ætius mentions camphor, but it cannot be found, as Dr. Alston has observed, in that or in any other Greek author. There is a *camphoræ herba* in Myrepsus; but this is evidently a very different thing.

nificence, and from the very spirit of their religion credulous and romantic, it is not a matter of surprise that their first researches into the nature of bodies should have raised a hope, and excited a belief, that the baser metals might be converted into gold.

They conceived that gold was the metallic element, in a state of perfect purity, and that all the other metals differed from it in proportion only to the extent of their individual contamination; and hence the origin of the epithet *base*, as applied to such metals. This hypothesis explains the origin of alchemy; but in every history we are informed that the earlier alchemists expected, by the same means that they hoped to convert the *baser* metals into gold, to produce an universal remedy, calculated to prolong indefinitely the span of human existence.

It is difficult to imagine what connexion could exist in their ideas between the "*Philosopher's Stone*," which was to transmute metals, and a remedy which could arrest the progress of bodily infirmity: upon searching, however, into the writings of these times, it appears probable that this conceit may have originated with the alchemists from the application of false analogies, and that the error was subsequently diffused and exaggerated by a misconstruction of alchemical metaphors.*

An example of reasoning by false analogy is presented to us by Paracelsus, in his work *de vita longâ*, wherein, speaking

* The records of physic, if I am not deceived, will afford numerous instances of similar error, from mistaking figurative expressions for literal truths. A knowledge of this species of fallacy will explain the origin of several very extraordinary receipts. I shall select the following instance, by way of illustration. "In many of the ancient works on physic we find the *blood of the goat* extolled for its efficacy in dissolving stones, and, from this supposed lithontriptic virtue, it forms the principal ingredient of the POWDER OF NICOLAUS, and of the ELECTUARY OF THE QUEEN OF COLEIN. The expression which gave origin to this belief was evidently allegorical, signifying that the blood of the goat, by which our Saviour was typified, was capable of softening the stony hearts of his enemies, or, according to others, that by his influence the stony rocks and vail of the temple were shattered."—*Browne's Vulgar Errors.*

of antimony, he exclaims, "*Sicut antimonium finit aurum, sic, eâdem ratione et formâ, corpus humanum purum reddit.*"

The processes of alchemy were always veiled in the most enigmatic and obscure language; the earliest alchemist whose name has reached posterity, is Geber, an Arabian prince of the seventh century, whose language was so proverbially obscure, that Dr. Johnson supposes the word gibberish, or *geberish*, to have been derived from this circumstance; sometimes the processes of alchemy were expressed by a figurative and metaphorical style of description; thus Geber exclaims, "*Bring me the six lepers, that I may cleanse them;*" by which he implied the conversion of the six metals,* the only ones then known, into gold. From the works of later alchemists it also appears that they constantly represented *gold* as a sound, healthy, and durable man, the imperfect metals as diseased men, and the means or processes by which the latter were to be transmuted into the former, they designated by the name of *medicines;* and hence, those who were anxious to dive into the secrets of these magicians, or **Adepts**, as they termed themselves, without possessing a key to the language, supposed that these descriptions were to be understood in a literal sense, and that the imperfect metals might be changed into gold, and the bodies of sick persons into healthy ones, by one and the same chemical preparation.

The hieroglyphical style of writing adopted by the earlier alchemists, was in a great degree supported by the prevailing idea that the elements were under the dominion of spiritual beings, who might be submitted to human power; and Sir Humphry Davy has observed that the notions of fairies, and of genii, which have been depicted with so much vividness of fancy and liveliness of description in THE THOUSAND AND ONE NIGHTS, seem to have been connected with the pursuit of the science of transmutation, and the production of the elixir of life. That the Arabian Nights' Entertainment admits of a mystic interpretation, is an opinion which I have long enter-

* Silver, mercury, copper, iron, tin, lead.

tained. How strikingly is the effect of fermented spirit, in banishing the pressure of the melancholy which occurs in solitude, depicted in the story of Sinbad, when he encountered the withered and decrepit hag, on the uninhabited island! But, to return from this digression to the subject of medical chemistry.

It was not in fact until several years had elapsed in the delusive researches of alchemy, that the application of chemical knowledge became instrumental in the advancement of the medical art. RHASES and AVICENNA, who were the celebrated physicians of the age, are the first who introduced pharmaceutical preparations into their works, or made any improvement in the mode of conducting pharmaceutical processes. Avicenna describes, particularly, the method of conducting *distillation;* he mentions also, for the first time, the three *Mineral Acids*, and distinguishes between the *vegetable* and *mineral alkalies;* he speaks likewise of the *Distilled Water of Roses*, of *Sublimed Arsenic*, and of *Corrosive Sublimate.*

In the year 1226, ROGER BACON, a native of Ilchester in Somersetshire, and a Franciscan monk of Westminster Abbey, laid the foundations of chemical science in Europe; his discoveries were so extraordinary that he was excommunicated by the Pope, Nicolas, and imprisoned ten years for supposed dealings with the devil; it appears that he was a believer in an universal elixir, for he proposed one to Pope Clement the Tenth, which he extolled highly, as the invention of Petro de Maharncourt, a Picard.*

* "For the preparation of this elixir," says the inventor, "you must take that which is temperate in the fourth degree; that which swims in the sea; that which vegetates in the air; that which is cast out by the sea; that which is found in the bowels of a long-lived animal; a plant of India; and two creeping things which are the food of Tyrians and Egyptians, and let them all be properly prepared. This *riddle* Bacon explains in the following manner: 'That which is temperate in the fourth degree is *gold*, chemically prepared; what swims in the sea is *pearl;* the flower of *rosemary* grows by virtue of the air; *spermaceti* is thrown out

This wonderful man was succeeded, at the end of the same century, by Arnoldus de Villa Nova, a Frenchman, or, as others assert, a Spaniard, who deserves to be noticed on this occasion, as being the first to recommend the distilled spirit of wine, impregnated with certain herbs, as a valuable remedy, from which we may date the introduction of *Tinctures* into medical practice; for although Thaddeus, a Florentine, who died, in 1270, at the age of eighty, bestows great commendation upon the virtues of *Spirit of Wine*, yet he never used it as a solvent for active vegetable matter.

It was not, however, until the end of the thirteenth century, that chemistry can be said to have added any considerable power to the arm of physic.

Basil Valentine, a German Benedictine monk, led the way to the internal administration of metallic medicine, by a variety of experiments on the nature of *Antimony*, and in his "*Currus Triumphalis Antimonii*," a work written in high Dutch, he has described a number of the combinations of that metal. If, however, we may credit a vague tradition, he was extremely unfortunate in his first experiments upon his brother monks, all of whom he injured, if not killed. Those who have keen ears for etymological sounds will instantly recognise, in this circumstance, the origin of the word *Antimony*,—*ἀντί Μοναχους*.

It appears that the ancients were ignorant of the internal use and administration of the metals, with the exception of iron, although they frequently used them in external applications. Hippocrates recommends *lead* in several parts of his works, as an *epulotic* application, and for other external pur-

by the sea; the *bone* found in a stag's heart is taken out of the bowels of a long-lived animal; the Indian plant is *lignum aloës*; and the creeping things are *serpents*, of which the flesh must be properly prepared.'" "This antidote," says Bacon, "prevents the corruption of any constitution, and the infirmities of age for many years." But, alas! in spite of this antidote, his friend Pope Clement died soon after, and left him to the mercy of his old enemy, Pope Nicolas.

poses. *Litharge of gold* and *Cerusse* also entered the composition of several powders extolled by that ancient physician as possessing great efficacy in defluxions of the eyes. Oribasius and Ætius added a "*Lithargyrium*" to several plasters, and the composition of the "*Snow-like plaster*," from *Minium*, was long preserved amongst their most valuable secrets. Whether antimony is the *Stimmi* or *Stibium* of the ancients has been a matter of conjecture: for Pliny, in speaking of its preparation, observes, "Ante omnia urendi modus necessarius, ne *Plumbum* fiat." This plumbum, however, was evidently the revived metal of *antimony*, with which the ancients were unacquainted, and therefore mistook it for *lead;* besides, the word *plumbum*, like many others which I have before mentioned, was used as a general term;* thus, according to Pliny, tin was called *plumbum album;* and Agricola calls lead, plumbum *nigrum.*†

The question, however, is unimportant, for this *Stibium* was never used but as an external astringent, especially for the purpose of contracting the eyelids, and thereby of making the eyes appear very large, which has been considered, from the most remote antiquity, as a feature of great beauty; thus the epithet *βοῶπις* is constantly applied by Homer to Juno. This practice appears also to have been followed by the Jews, for Jezebel is said to have painted her eyebrows to make her eyes appear big;‡ the expression also shows that the drug employed was the *Stimmi.* *Εστίμμίσατο τους οφθαλμους αυτης.*

To Basil Valentine we are moreover indebted for the discovery of the *Volatile Alkali*, and of its preparation from *Sal Ammoniac;* he also first used mineral acids as solvents, and noticed the production of *Ether* from Alcohol; he seems

* The term, as applied to money, has been supposed by Pinkerton and others to signify a coin of no value; to be, in fact, a mere expression of contempt.

† Agricola de veteribus et novis metallis, Lib. i.

‡ 2 Kings, chap. ix. verse 30.

also to have understood the virtues of *sulphate of iron*, for he says, when internally administered, it is tonic and comforting to a weak stomach, and that, externally applied, it is astringent and styptic: he moreover recommended a *fixed alkali* made from vine twigs cut in the beginning of March, for the cure of gout and gravel.

In the year 1493 was born, near Zurich in Switzerland, PARACELSUS, or, as he termed himself, Philippus-Theophrastus-Bombastus Paracelsus de Hohenheim, a man who was destined to produce a greater revolution in the Materia Medica, and a greater change in medical opinions and practice, than any person who had appeared since the days of Galen. He travelled all over the continent of Europe to obtain knowledge in chemistry and physic, and was a great admirer of Basil Valentine, declaring that antimony was not to be equalled, for medicinal virtue, by any other substance in nature: this opinion, however, does not deserve our respect, for it was not founded upon observation and experiment, but on a fanciful analogy, derived from a property which this metal possesses of refining gold, as I have before related. He also used *mercury* without reserve, and appears to have been the first who ventured to administer it internally;* for although Avicenna asserts that it was not so poisonous as the ancients had imagined, yet he does not attribute to it any virtues; he merely says, "Argentum quidem vivum, plurimi qui bibunt, *non læduntur* eo." Its effects, when applied externally, were well known to Theodoric the friar, afterwards Bishop of Cervia, in the twelfth century, who describes the salivation which mercurial frictions will produce. Paracelsus, moreover, employed lead internally in fevers,—"*Saturnus purgat febres*," was one of his most favourite maxims. He also gives us

* It has been already stated, that we are indebted to an Indian for the discovery of bark, and it now appears we derived our knowledge of mercury from the wildest of the alchemists. May it not then be said that we are indebted to a *savage*, and a *madman*, for two of our most powerful remedies?

directions for the preparation of *Red Precipitate* with *mercury* and *aqua fortis*. Uninfluenced by the prevailing prejudice of the time, that opium was cold in the fourth degree, he administered this narcotic, the use of which he had learned from the Turks, with a liberal hand; a practice which gave him a great advantage over his contemporaries.

Paracelsus, thus armed with opium, mercury, and antimony, remedies of no trifling importance, travelled in all directions, and performed many extraordinary cures, amongst which was that of the famous printer Frobenius of Basil, a circumstance which immediately brought him acquainted with Erasmus,* and made him known to the magistracy of Basil, who elected him professor of chemistry in the year 1527, which was the first professorship that was established in Europe for the promotion and dissemination of chemical science. But notwithstanding this testimony of his success, if we may credit Libavius, he often, like our modern quacks, left his patients more diseased than he found them; and it is acknowledged by his own disciple, Oporinus, that when he was sent for to any town, for the purpose of administering his remedies, he was rarely suffered to protract his visit, on account of the general resentment of the inhabitants.

While seated in his chair, he burnt with great solemnity the writings of Galen and Avicenna, and declared to his audience that if God would not impart the secrets of physic, it was not only allowable, but even justifiable, to consult the devil. His contemporary physicians he treated with the most sottish vanity and illiberal insolence. In the preface to his work entitled "Paragranum," he tells them, "that the very down of his bald pate had more knowledge than all their

* Erasmus, the friend, the correspondent, and the patient of our own Linacre! "Had not modern times," says Sir George Baker, "furnished similar instances, it would have been a matter of astonishment to us to have heard that Erasmus should have deserted an accomplished physician whom he so greatly extols in his epistles, in order to consult so wild and illiterate an enthusiast as Paracelsus."

writers, the buckles of his shoes more learning than Galen and Avicenna, and his beard more experience than all their universities." With such a temper it could not be supposed that he would long retain his chair: in fact, he quitted it in consequence of a quarrel with the magistrates, after which he continued to ramble about the country, generally intoxicated, and seldom changing his clothes, or even going to bed; and although he boasted of possessing a *Panacea* which was capable of curing all diseases in an instant, and even of prolonging life to an indefinite length, yet this drunkard and prince of empirics died after a few hours' illness, in the forty-eighth year of his age, at Salzburg in Bavaria, with a bottle of his immortal *Catholicon* in his pocket.*

In contemplating the career of this extraordinary man, it is difficult to say whether disgust or astonishment is the most predominant feeling; his insolence and unparalleled conceit, his insincerity and brutal singularities, and his habits of immorality and debauchery, are beyond all censure; whilst the important services he has rendered mankind, by opposing the bigotry of the schools, and introducing powerful remedies into practice, cannot be recorded without feelings of gratitude and respect; but in whatever estimation Paracelsus may be held, there can be no doubt but that his fame produced a very considerable influence on the character of the age, by exciting the envy of some, the emulation of others, and the industry of all.†

About a century after Paracelsus, Van Helmont took the lead in physic; he was a man of most indefatigable industry,

* The monument of this extraordinary person is still to be seen in the church of St. Sebastian in Salzburg. "It is very simple, and formed of the red brown marble of the country. It bears his head in relief, and an inscription, which is a proof of the great esteem in which his memory was held even till the middle of the eighteenth century."—*Tobin's Journal of a Tour.*

† Paracelsus maintained that the human body is composed of salt, sulphur, and mercury, and that in these "*three first substances,*" as he calls them, health and disease consist; that the mercury, in proportion to its

and spent fifty years in torturing, by every chemical experiment he could devise, the various objects in the animal, vegetable, and mineral kingdoms. To him we are indebted for having first noticed the existence of several permanently elastic fluids or *airs*, whose properties differed from those of common air, and to which he gave the name of *gases*. He was the first physician who applied *alum* in uterine hæmorrhage, and he acquired a great reputation from the success of the practice. Although Paracelsus* had published some wild notions on the subject of calculi, Van Helmont, in his treatise "*De Lithiasi*," was the first who attempted to investigate the subject by experiment, and he certainly obtained some important results, viz. that urinary calculi were quite different from the stony bodies of the mineral kingdom.

Sylvius de la Boe, and Otho Tachenius, followed in the track of Van Helmont.

A feeling in favour of chemical remedies having been thus introduced, the merited success which attended their operation, and the zeal and perseverance which distinguished the votaries of that science, soon kindled a more general enthusiasm in its favour. It is impossible to reduce into miniature the historical features of these chemical times, so as to bring them within any reasonable compass: I must therefore rest satisfied with delineating a few of the more prominent outlines. The Galenists, who were in possession of the schools, and whose reasonings were fettered by the strongest predilection for their own doctrines, instantly took the alarm; and the celebrated contest ensued between the *Galenical* and *Chemical* sects, which has given such a controversial tone to the writers

volatility, produces tremors, mortifications in the ligaments, madness, frenzy, and delirium; and that fevers, phlegmons, and the jaundice, are the offspring of the *sulphureous* principle, while he supposed that the cholic, stone, gravel, gout, and sciatica, derive their origin from *salt*.

* Paracelsus conceived that the generation of tartar was the source of these diseases; and he supposed that calculi were produced from the liquids of the body in the same way that tartar is deposited from wine.

of the fifteenth and sixteenth centuries. As this revolt from orthodox authority was in a great degree attributed to the mischievous introduction and unmerited success of antimonial remedies, so were the preparations of this metal denounced with all the virulence of party spirit:* and upon this occasion. in order to support their ground and oppress and persecute their adversaries, the Galenists actually solicited the assistance of secular power; the supreme council of Paris accordingly proscribed its use by an edict in 1566, and Besnier was expelled the faculty of medicine in 1609, for having administered it to a patient. Such violence serves only to display the extreme ignorance of the age. In this respect, it has been observed, that man may claim his affinity to animals of another class, who are never so fierce as when in the dark. In 1637 *antimonial wine* was by public authority received into the number of purgatives; and in 1650 a new *arrêt* rescinded that of 1566, and again restored antimony to public favour and general reputation; and before we conclude our remarks upon the revolutionary history of this extraordinary metal, it deserves to be remarked, that this very same government that had with such great virulence, and so little justice, persecuted every practitioner who had shown any predilection for its use, in the year 1720 actually purchased the secret of an antimonial preparation, called *Panacea Glauberiana*, and which has been since known by the title of *Kermes Mineral*, from a surgeon of the name of La Legerie, who had acquired the secret from the pupil of Glauber. Before this period the invention of *calomel* had taken place; this preparation is first mentioned, although very obscurely, by Oswald Crollius, in his *Basilica Chemica*, in 1608, and in the same year Beguin

* Amongst the writers engaged in this contest, no one was more animated with party spirit than Guy Patin, who was profuse in his personalities against those who defended the use of antimony; he drew up a long register of the unsuccessful cases in which this medicine had been employed, which he published under the title of "Antimonial Martyrology."

described it most fully and clearly under the title of *Draco Mitigatus*, in his *Tirocinium Chemicum*, which was published in Paris in the same year.

Chemistry at this period* took possession of the schools, and whilst it was gradually grafted into the theory of medicine, it soon became the only guide to its practice, the absurdity of which has been already dwelt upon.

In tracing the march of chemical improvement during the last century, we cannot but be struck with the new and powerful remedies which it has introduced, and the many unimportant and feeble articles which it has dismissed from practice.

In the present century the rapid progress of this science has far exceeded the anticipations of its most sanguine votaries; and even in the difficult department of vegetable analysis, a correctness has been attained, the very attempt at which had been abandoned by the most illustrious chemists of the former age as hopeless and chimerical. How highly interesting is it to compare the results obtained by the academicians of Paris, and published by Geoffroy, in their analyses of several hundred plants by the operation of heat, with the refined and accurate researches in the same branch of science more recently conducted in that country. The former even failed in establishing the least distinction between the most salubrious and the most poisonous plants, while the latter have detected, separated, and concentrated, the subtile principles upon which their characteristic qualities depend. *Opium* has thus been compelled to confess its secret source of action; *ipecacuan* to yield its emetic element, and *Peruvian bark* to present its essential principles in a state of the most surprising concentration; while other powerful vegetables have been so successfully analysed as to afford their active constituents in forms of extraordinary activity. Nor have the

* In the year 1644 Schroeder published a *Chemico*-medical Pharmacopœia, which delineates with accuracy the pharmacy of these times, and enumerates almost all the chemical medicines that were known towards the close of this period.

labours of our contemporaries been confined to the investigation of *proximate* principles; they have been equally successful in the prosecution of *ultimate* analysis; and our German brethren, so victoriously led by Liebig and Dumas, have, with atomic precision, traced the numerous metamorphoses of which vegetable bodies are susceptible, and discovered the laws by which they are governed.

Our pharmacopœias and dispensatories have cautiously kept pace with the scientific progress of the age; and in tracing them from their origin to the present day,* it is gratifying to observe the gradual influence of scientific knowledge in reducing the number of their articles, in simplifying the composition of their formulæ, and in improving the processes for their preparation.

Chemistry has also been serviceable in establishing the identity of bodies long regarded as specifically different; thus, an extensive list of animal substances has deen discarded, since it is known that they owe their properties to one and the same common principle, as to *gelatine*, *albumen*, *carbonate of lime*, &c.; so, again, every animal substance containing *nitrogen* is now known to furnish *ammonia*, and this product is acknowledged to be identical in every case. Such discoveries have necessarily discarded from our Materia Medica numerous

* The first Pharmacopœia was published at Nuremburg, under the sanction of its senate, in the year 1542. For this important act we are indebted to Valerius Cordus, a young student, who, during a transient visit at that place, accidentally produced a collection of medical receipts which he had selected from the works of the most esteemed writers, and with which the physicians of Nuremburg were so highly pleased, that they urged him to print it for the benefit of the apothecaries, and obtained the sanction of the senate to the undertaking; so casual was the circumstance to which we owe the institution of Pharmacopœias. The London College were among the last to frame a standard code; most cities in Europe having anticipated us in the performance of this duty. Our first Pharmacopœia was not published until the reign of James I., A.D. 1618, exactly a century after the college had received their charter from Henry. Successive editions appeared in the following years, viz. in 1650, 1677, 1721, 1746, 1787, 1809, 1824, 1836.

articles, as earth-worms, or vipers skinned, and deprived of their entrails—human skull—dried blood—elk's hoof—urine of a child, or that of a healthy young man, &c. In like manner, the fixed alkaline salt, produced by the incineration of different vegetables, has been found to be *potass*, from whatever plant it may have been obtained, with the exception of marine plants, and, perhaps, some of the Tetradynamia, the former of which yield *soda*, and the latter *ammonia*. Previous to the pharmacopœia of 1745, every vegetable was supposed to yield a salt essentially different, and therefore a variety of alkaline preparations were admitted, each bearing the name of the particular plant from which it had been procured, as *salt of wormwood*, *salt of broom*, *salt of bean-stalks*, &c.

The influence which chemistry has exerted upon modern practice, and the reliance which can be placed upon the theories to which it has given origin, will be fully discussed in the Second Part of this work, under the head of "CHEMICAL REMEDIES."

DEVOTION TO AUTHORITY AND ESTABLISHED ROUTINE.

This has always been the means of opposing the progress of reason, the advancement of natural truths, and the prosecution of new discoveries; whilst, with effects no less baneful, has it perpetuated many of the errors which have been already enumerated, as well as others not less influential, and which are reserved for future consideration.

To give a general currency to an hypothetical opinion, or medicinal reputation to an inert substance, nothing more is required than the talismanic aid of a few great names; when once established upon such a basis, ingenuity, argument, and

even experiment, may open their ineffectual batteries; the laconic sentiment of the Roman satirist is ever opposed to remonstrance—"*Marcus dixit? ita est.*" A physician cannot err in the opinion of the public, if he implicitly obeys the dogmas of authority. In the most barbarous ages of ancient Egypt, he was punished or rewarded according to the extent of his success; but to escape the former it was only necessary to show that an orthodox plan of cure had been followed, such as was prescribed in the acknowledged writings of Hermes. It is an instinct in our nature to follow the track pointed out by a few leaders; we are gregarious animals, in a moral as well as a physical sense, and we are addicted to routine because it is always easier to follow the opinions of others than to reason and judge for ourselves; and thus do one half of the world live as alms-folks on the opinions of the other half. What but such a temper could have upheld the preposterous system of Galen for more than thirteen centuries, and have enabled it to give universal laws in medicine to Europe, Africa, and part of Asia?* What, but the spell of authority, could have inspired a general belief that the sooty washings of resin could act as a universal remedy?† What, but a blind devotion to authority, or an insuperable attachment to established custom and routine, could have so long preserved from oblivion the absurd medicines which abound in our earlier dispensatories? for example, the "*Decoctum ad Ictericos*" of

* Massaria, a learned professor of Pavia, in the sixteenth century, absolutely declared that he would rather err with Galen, than be in the right with any other physician.

† This practice of Bishop Berkeley has been ridiculed with great point and effect in a pamphlet entitled "A CURE FOR THE EPIDEMICAL MADNESS OF DRINKING TAR-WATER," by A. Reeve; in which, addressing the Bishop, he says, "Thus, in your younger days, my lord, you made the surprising discovery of the unreality of matter, and now, in your riper age, you have undertaken to prove the reality of an universal remedy; an attempt to talk men out of their reason did of right belong to that author who had first tried to persuade them out of their senses." Tar-water was also at one time supposed to possess very considerable virtues in syphilis.

the Edinburgh College, which never had any foundation but that of the doctrine of signatures,* in favour of the *Curcuma* and *Chelidonium majus;* and it is only within a few years that the *Theriaca Andromachi*, in its ancient form, has been dismissed from our Pharmacopœia.† The CODEX MEDICAMENTARIUS of Paris still cherishes the many-headed monster of pharmacy, under the appropriate title of "*Electuarium Opiatum Polupharmacum.*" ‡

* The *Euphrasia Officinalis*, or *Eye-bright*, which is indebted for its celebrity to the doctrine of signatures, as before stated, is employed at this day in cases of dimness of sight. See a paper upon the efficacy of this plant by Dr. Jackson, in the London Medical and Physical Journal, vol. xxiii. p. 104.

† Its rejection was proposed by the late Dr. Heberden, and upon the college dividing on the question, there were found to be *thirteen* votes for retaining, and *fourteen* for rejecting it.

‡ This preparation consists of seventy-two ingredients, which are arranged under thirteen heads, viz. ACRIA, of which there are five species; AMARA, of which there are eight; STYPTICA vulgo ASTRINGENTIA, five in number; AROMATICA EXOTICA, fourteen; AROMATICA INDIGENA, ten; AROMATICA EX UMBELLIFERIS, seven; RESINOSA ET BALSAMA, eight; GRAVE-OLENTIA, six; VIROSA, *seu quæ Narcosin inducunt*, under which head there is but one species, viz. opium; TERREA INSIPIDA ET INERTIA, this comprises only the *Lemnian earth;* GUMMOSA, AMYLACEA, &c. four species; DULCIA, *liquorice and honey;* VINUM, *Spanish.*

Upon no principle of combination can this heterogeneous farrago be vindicated. It has, however, enjoyed the confidence of physicians for many ages, and is therefore entitled to some notice. It was supposed to have been invented by Mithridates, the famous king of Pontus, the receipt for which was said to have been found among his papers after his defeat by Pompey, at which time it was published in Rome, under the title of "Antidotum Mithridatium." "But the probability is," says Dr. Heberden, "that Mithridates was as much a stranger to his own antidote as several eminent physicians have since been to the medicines that are daily advertised under their names. It was asserted, that whoever took a proper quantity in the morning was insured from poison during the whole of that day, (Galen de Antidot. Lib. i.,) and it was further stated, that Mithridates himself was so fortified against all baneful drugs, that none would produce any effect when he attempted to destroy himself. (Celsus, lib. v. c. xxiii.) In the course of ages it has undergone numerous alterations. According to Celsus, who first described it, it contained only thirty-five simples; Andromachus, physician to Nero, added vipers,

It is, however, evidently indebted for this unexpected rescue from oblivion to a cause very remote from that which may be at first imagined; not from any belief in its powers, or reliance upon its efficacy, but from a passive acquiescence in a generally received opinion, and a disinclination to oppose popular prejudice, or to reject what has been established by authority and sanctioned by time. For the same reason, and in violation of their better judgment, the editors have retained the absurd formula of Diest for the preparation of an extract of opium, which, after directing various successive operations, concludes by ordering the decoction to be boiled incessantly for six months, supplying the waste of water at intervals! Many of the compound formulæ in this Codex, it is frankly allowed, possess an unnecessary and unmeaning, if not an injurious complexity; and yet such force has habit, and so paramount are the *verba magistri*, that the editors are satisfied in distinguishing the more important ingredients by printing them in *italics*, leaving the rest to be supplied at the whim and caprice of the dispenser; and thus are the grand objects and use of a national Pharmacopœia defeated, which should above all things insure uniformity in the strength and composition of its officinal preparations.

The same devotion to authority which induces us to retain an accustomed remedy with pertinacity, will frequently oppose the introduction of a novel practice with asperity, unless indeed it be supported by authority of still greater weight

and increased the number of ingredients to seventy-five; and when thus *reformed* he called it γαλήνη—but in Trajan's time it obtained the name of *Theriaca*, either from the vipers in it, or from its supposed effects in curing the bites of venomous animals. Damocrates gave a receipt for it in Greek iambics, which has been preserved by Galen. It appears, then, that its composition has hardly remained the same for a hundred years; "it is," says Dr. Heberden, "a farrago, that has no better title to the name of Mithridates than as it so well resembles the numerous undisciplined forces of a barbarous king, made up of a dissonant crowd collected from different countries, mighty in appearance, but in reality an ineffective multitude, that only hinder each other." ΑΝΤΙΘΗΡΙΑΚΑ, by W. Heberden, M.D. 1745.

and consideration. The history of various articles of diet and medicine will prove in a striking manner how greatly their reputation and fate have depended upon authority. It was not until many years after *Ipecacuan* had been imported into Europe, that Helvetius, under the patronage of Louis XIV., succeeded in introducing it into practice: and to the eulogy of Katharine, queen of Charles II., we are indebted for the general introduction of tea into England.*

That most extraordinary plant† *tobacco*, notwithstanding its

* The consumption of tea has greatly increased in England during the last thirty years. In 1787 the total amounted to sixteen millions of pounds, whereas in 1821 it exceeded twenty-two millions.

† Hernandez de Toledo sent this plant into Spain and Portugal in 1559, when Jean Nicot was ambassador at the Court of Lisbon from Francis II., and he transmitted, or carried either the seed or the plant to Catherine de Medicis: it was then considered as one of the wonders of the new world, and was supposed to possess very extraordinary virtues: this seems to be the first authentic record of the introduction of this plant into Europe. In 1589 the Cardinal Santa Croce, returning from his nunciature in Spain and Portugal to Italy, carried thither with him tobacco, and we may form some notion of the enthusiasm with which its production was hailed, from a perusal of the poetry which the subject inspired; the poets compare the exploit of the holy cardinal with that of his progenitor who brought home the wood of the true cross.

> . . . . . "Herb of immortal fame!
> Which hither first with Santa Croce came,
> When he, his time of nunciature expired,
> Back from the court of Portugal retired;
> Even as his predecessor, great and good,
> Brought home the cross."

In England, it is said that the smoking tobacco was first introduced by Sir Walter Raleigh on his return from America. James the First wrote a philippic against it, entitled "A Counterblaste to Tobacco," in which the royal author, with more prejudice than dignity, informs his loving subjects that "it is a custome loathsome to the eye, hatefull to the nose, harmfull to the braine, dangerous to the lungs; and in the blacke stinking fume thereof, neerest resembling the horrible Stygian smoake of the pit that is bottomlesse." In 1604 this monarch endeavoured, by means of heavy imposts, to abolish its use in this country;

powers of fascination, has suffered romantic vicissitudes in its fame and character; it has been successively opposed and commended by physicians—condemned and eulogised by priests and kings—and proscribed and protected by governments; whilst at length this once insignificant production of a little island, or an obscure district, has succeeded in diffusing itself through every climate, and in subjecting the inhabitants of every country to its dominion. The Arab cultivates it in the burning desert—the Laplander and Esquimaux risk their lives to procure a refreshment so delicious in their wintry solitude—the seaman, grant him but this luxury, and he will endure with cheerfulness every other privation, and defy the fury of the raging elements; and in the higher walks of civilised society, at the shrine of fashion, in the palace, and

and in 1619 he commanded that no planter in Virginia should cultivate more than one hundred pounds. It must be confessed that some legislative enactment was necessary at this period for restricting the custom of smoking tobacco, for we are told in the *Counterblaste,* that many persons expended as much as five hundred pounds per annum in the purchase of this article, which in those days was an enormous amount.

In 1624 Pope Urban the VIIIth published a decree of excommunication against all who took snuff in the church. Ten years after this, smoking was forbidden in Russia, under the pain of having the nose cut off; in 1653 the Council of the Canton of Appenzel cited smokers before them, whom they punished, and they ordered all innkeepers to inform against such as were found smoking in their houses. The police regulations of Bern, made in 1661, were divided according to the Ten Commandments, in which the prohibition of smoking stands immediately beneath the command against adultery; this prohibition was renewed in 1675, and the tribunal instituted to put it into execution, viz. Chambreau Tabac, continued to the middle of the eighteenth century. Pope Innocent the XIIth in 1690 excommunicated all those who were found taking snuff or tobacco in the church of St. Peter at Rome; even so late as 1719 the Senate of Strasburgh prohibited the cultivation of tobacco, from an apprehension that it would diminish the growth of corn; Amurath the IVth published an edict which made smoking tobacco a capital offence; this was founded on an opinion that it rendered the people infertile. Those who are curious to learn more of the history of this extraordinary plant, I beg to refer to a very interesting paper by "Medicus," in the twenty-fourth volume of the "London Medical and Physical Journal," page 445, and more especially to an elaborate "Essay on Tobacco," by H. W. Cleland, M. D., Lecturer on Medical Jurisprudence, Glasgow.

in the cottage, the fascinating influence of this singular plant commands an equal tribute of devotion and attachment.

The history of the potato is perhaps not less extraordinary, and is strikingly illustrative of the omnipotent influence of authority. The introduction of this valuable plant received, for more than two centuries, an unexampled opposition from vulgar prejudice, which all the philosophy of the age was unable to dissipate, until Louis the Fifteenth wore a bunch of the flowers of the potato, in the midst of his court, on a day of festivity; the people then, for the first time, obsequiously acknowledged its utility, and ventured to express their astonishment at the apathy which had so long prevailed with regard to its general cultivation. That which authority thus established, time and experience have fully ratified, and scientific research has extended the numerous resources which this plant is so wonderfully calculated to furnish; thus its stalk, considered as a textile plant, produces in Austria a cottony flax—in Sweden, sugar is extracted from its root—by combustion its different parts yield a very considerable quantity of potass—its apples, when ripe, ferment and yield vinegar by exposure, or spirit by distillation—its tubercles made into a pulp are a substitute for soap in bleaching—cooked by steam, the potato is the most wholesome and nutritious, and at the same time the most economical of all vegetable aliments*—by different manipulations it furnishes two kinds of flour, a gruel and a parenchyma, which in times of scarcity may be made into bread, or applied to increase the bulk of bread made from grain—to the invalid it furnishes both aliment and medicine: its starch is not in the least inferior to the Indian arrow-root; and Dr. Latham has shown that an extract may be prepared from its leaves and flowers, which possesses properties as an anodyne remedy.†

* What other discovery or invention ever produced such political consequences as the introduction of the potato as an article of food? From its operation as the main constituent of national sustenance, the population of Ireland has advanced from little more than one million to near seven millions, within the last century and a half!

† Med. Trans. of the College of Physicians, vol. vi. p. 92.

The history of the warm bath* presents us with another curious instance of the vicissitudes to which the reputation of our valuable resources is so universally exposed; that which for so many ages was esteemed the greatest luxury in health,† and the most efficacious remedy in disease, fell into total disrepute in the reign of Augustus, for no other reason than because Antonius Musa had cured the emperor of a dangerous malady by the use of the *cold* bath. The most frigid water that could be procured was, in consequence, recommended on every occasion: thus Horace, in his epistle to Vala, exclaims—

> "——— Caput ac stomachum supponere fontibus audent
> Clusinis, gabiosque petunt, et frigida rura."
>
> *Epist.* xv. *Lib.* i.

This practice, however, was doomed but to an ephemeral popularity, for although it had restored the emperor to health, it shortly afterwards killed his nephew and son-in-law, Marcellus; an event which at once deprived the remedy of its credit and the physician of his popularity.

The history of the Peruvian bark would furnish a very curious illustration of the overbearing influence of authority in giving celebrity to a medicine, or in depriving it of that reputation to which its virtues entitle it. This heroic remedy was first brought to Spain in the year 1632, and we learn from Villerobel that it remained for seven years in that country before any trial was made of its powers, a certain ecclesiastic of Alcala being the first person in Spain to whom it was administered in the year 1639; but even at this period its use was limited, and it would have sunk into oblivion but for the

* That the *warm* and not the *cold* bath was esteemed by the ancient Greeks, for its invigorating properties, may be inferred from a dialogue of Aristophanes, in which one of the characters says, "I think none of the sons of the gods ever exceeded Hercules in bodily and mental force;"—upon which the other asks, "Where didst thou ever see a *cold* bath dedicated to Hercules?"

† The prohibition of the bath was numbered amongst the mortifications to which certain priestesses in Greece were bound by the rigid rules of their order.

supreme power of the Roman church, by whose auspices it was enabled to gain a temporary triumph over the passions and prejudices which opposed its introduction. Innocent the Tenth, at the intercession of Cardinal de Lugo, who was formerly a Spanish Jesuit, ordered that the nature and effects of it should be duly examined, and upon being reported as both innocent and salutary, it immediately rose into public notice;* its career, however, was suddenly stopped by its having unfortunately failed, in the autumn of 1652, to cure Leopold, Archduke of Austria, of a quartan intermittent; this disappointment kindled the resentment of the prince's principal physician, Chifletius, who published a violent philippic against the virtues of Peruvian bark, which so fomented the prejudices against its use, that it had nearly fallen into total neglect and disrepute.

Thus there exists a fashion in medicine, as in the other affairs of life, regulated by the caprice and supported by the authority of a few leading practitioners, which has been frequently the occasion of dismissing from practice valuable medicines, and of substituting others, less certain in their effects, and more questionable in their nature. As years and fashions revolve, so have these neglected remedies, each in its turn, risen again into favour and notice, whilst old receipts, like old almanacs, are abandoned until the period may arrive, that will once more adapt them to the spirit and fashion of the times. Thus it happens that many of our "*new discoveries*" in the Materia Medica have turned out to be no more than the revival and adaptation of ancient practices. In the last century the root of the *Aspidium Felix*, the male fern, was retailed as a secret nostrum by Madame Nouffleur, a French empiric, for the cure of tapeworm; the secret was purchased for a considerable sum of money by Louis XV. and the physicians then discovered that the same remedy had been administered in that complaint by Galen.†

* T. Bartholini Hist. Anat. et Med. cent. v. Hafniæ. Med. Transactions, vol. iii. p. 177.

† MADAME NOUFFLEUR'S RECEIPT is as follows:— Three drachms of the

The history of popular medicines for the cure of gout will also afford us matter for illustration. The celebrated Duke of Portland's powder was no other than the *Diacentaureon* of Cælius Aurelianus, or the *Antidotos ex duobus Centaureæ generibus* of Ætius,* the receipt for which a friend of his Grace brought from Switzerland, into which country it had been probably introduced by the early medical writers, who had transcribed its virtues from the Greek volumes soon after their arrival into the western parts of Europe. The active ingredient of a no less celebrated remedy for the same disease, *the Eau Medicinale*,† has been discovered to be the *Colchicum Autumnale*, or meadow saffron. Upon investigating the properties of this medicine, it was observed that similar effects in the cure of the gout were ascribed to a certain plant, called *Hermodactyllus*,‡ by Oribasius and Ætius, but more particularly by Alexander of Tralles,§ a physician of Asia Minor, in the fourth century; an inquiry was accordingly instituted after this unknown plant, and upon procuring a specimen of it from Constantinople, it was actually found to be a species of *Colchicum*.

The use of Prussic acid in the cure of phthisis, which was proposed by Dr. Majendie, and introduced into the *Codex Me-*

root of the *male fern*, reduced to fine powder, and mixed with water; this constitutes one dose. Two hours after taking the powder, a bolus of calomel, scammony, and gamboge, is to be administered.

* Duke of Portland's powder for the gout.—Equal quantities of the roots of *gentian*, and birthwort (*aristolochia rotunda*,) the tops and leaves of germander (*chamædrys*), ground pine (*chamæpitys*), and lesser centaury (*chironea centaurium*), powdered and mixed together.—As this is a combination of bitters, it might, without doubt, be serviceable in certain cases of gout.

† This medicine was brought into vogue by M. Husson, a military officer in the service of France, about fifty years ago.

‡ So popular was this plant, that it acquired the title of "anima articulorum." It formed the basis of the dia articuloram, the pulvis arthriticus Turneri, and the Vienna gout decoction.

§ Alexander's prescription consisted of hermodactylls, ginger, pepper, cummin seed, aniseed, and scammony: which, says he, will enable those who take it to walk immediately.

dicamentarius of Paris, is little else than the revival of the Dutch practice in this complaint; for Linnæus informs us, in the fourth volume of his "*Amœnitates Academicæ*," that distilled laurel water was frequently used in Holland for the cure of pulmonary consumption.

The celebrated fever powder of Dr. James was evidently not his original composition, but an Italian nostrum invented by a person of the name of Lisle, a receipt for the preparation of which is to be found at length in *Colborne's Complete English Dispensatory for the year* 1756.*

The various secret preparations of opium, which have been extolled as the invention of modern times, may be recognized in the works of ancient authors; for instance, Wedelius, in his *Opiologia*, describes an acetic solution; and the *Magisterium* of Ludovicus, as noticed by Etmuller, was a preparation made by dissolving opium in vinegar, and precipitating with salt of tartar:† Van Helmont recommends a preparation, similar to the black drop, under the title of *Laudanum Cydoniatum;* then again we have Langelott's laudanum, and Le Mort's "*Extract out of rain water*," preparations which owe their mildness to the abstraction of the resinous element of opium.

The works of Glauber contain accounts of many discoveries that have been claimed by the chemists of our own day; he

* Some years since, I received a very interesting letter from Dr. Halliday of Moscow, in which he thus comments upon the above passage. "You attribute the invention of James's powder to one Lisle, which was not the fact; and as the original author was the father of a very old friend of mine, Mr. M'Intosh, perhaps you may think it worth while to correct the mistake in a future edition. The above inventor was a German apothecary and chemist, of the name of Schwanberg, with whom Dr. James was associated, and who, on obtaining the patent, vended a medicine which did not accord with the specification. Mr. M'Intosh, who was in the habit of preparing the medicine for the supply of Moscow, assured me that the formula given in the London Pharmacopœia for the pulvis antimonialis was something like the original receipt, but differed from it in certain particulars, which he was bound by an oath not to disclose."

† Magisterium opii fit solvendo opium in aceto, et præcipitando cum sale tartari. ———"

recommends the use of muriatic acid in sea scurvy, and describes an apparatus for its preparation exactly similar to that which has been extolled as the invention of Wolff; he also notices the production of *Pyro-acetic Acid* under the title of "*Vinegar of wood*," so that the fact of the identity of this acid and vinegar, announced by Vauquelin as a *new discovery*, was evidently known to Glauber nearly two centuries ago.

We have within the last few years heard much of the efficacy of henbane fumigations in the toothache, an application which may be easily shown to be the revival only of a very ancient practice.*

But while we might thus proceed to annul many other claims for originality, we ought not to close our eyes to the fallacies to which such investigations are peculiarly exposed. Nothing is more easy than to invest the doubtful sentence of an obscure author with an interpretation best adapted for the support of a favourite theory, and instances might be adduced where the medical antiquarian† has by violence and distortion forced the most contradictory passages into his service; treating, in short, the oracles of physic just as Lord Peter treated his father's will

* This was the favourite remedy of Dr. Andrew Boorde, who practised physic in Hampshire, and in his work printed in the black letter in London, entitled "A Breviarie of Health," he advises for a toothache depending upon worms, "a candell of waxe with henbane seeds, which must be lighted so that the perfume of the candell do enter into the tooth." This said Dr. Andrew Boorde is too important a personage to be passed over without some farther notice in this place, being no less than the founder of that dignified class of the medical fraternity, better known by the name of *merry Andrews*. Dr. Andrew Boorde lived in the reigns of Henry VIII., Edward VI., and Queen Mary, and was in the constant habit of frequenting fairs and markets, at which he harangued the populace publicly: his speeches were extremely humorous, and occasioned considerable mirth; his successors in this same line naturally endeavoured to imitate his bright example, and hence this class of itinerant quacks obtained the generic application of MERRY ANDREWS.

† I have been lately much amused with the lucubrations of a classical friend, who, by way of casting ridicule upon such researches, undertakes to prove to my satisfaction that WARREN'S BLACKING is no other than the νασμος μελανανγες, "*black flowing splendour*," described in the Hecuba of Euripides.

in the *Tale of a Tub*, — determined to discover the word "*shoulderknot*," he picks it out letter by letter, and is even at last obliged to substitute *c* for *k* in the orthography.

Nor has Fashion confined her baneful interference to the selection of remedies; she has ventured even to decide upon the nature of diseases, and to change and modify their appellations according to the whim and caprice by which she is governed. The Princess, afterwards Queen Anne, was subject to hypochondriacal attacks, which her physicians pronounced to be *Spleen*, *Vapours*, or *Hyp*, and recommended Rawleigh's Confection, and Pearl Cordial, for its cure; this circumstance was sufficient to render both the disease and remedy *fashionable;* no other complaint was ever heard of, in the precincts of the court, but that of the *Vapours*, nor was any medicine esteemed but that of Rawleigh. Some years afterwards, in consequence of Dr. Whytt's publication on "*Nervous Diseases*," a lady of fashion was pronounced to be *nervous;* and as ladies introduce fashions in physic as well as in millinery, the term became general, and the disease fashionable, and *Spleen*, *Vapours*, and *Hyp* were erased from the catalogue of maladies; the reign of nervous diseases however, was but transient; a popular work appeared on Biliary Concretions, and the fashionable world suddenly became extremely bilious. We might pursue the history of these follies, but let us hope that the past may not prove the mirror of the future.

THE ASSIGNING TO THE WORKINGS OF ART THE EFFECTS OF UNASSISTED NATURE; OR, THE CONSEQUENCES OF INCIDENTAL CHANGES OF HABIT, DIET, &c.

Our inability upon all occasions to appreciate the efforts of Nature in the cure of disease, must necessarily render our notions, with respect to the powers of art, liable to numerous

errors and deceptions. Hence protracted or *wire-drawn* cures ought to be very cautiously received as evidences of the success of medical treatment. Many diseases require only time to enable nature to remove them. All the long train connected with Hysteria are *cured by time;* the solution of which, as Mr. Travers has observed, is to be found in the fact, that the hysteric period wanes, and the restlessness of the temperament undergoes a slow but salutary change. Nothing, certainly, is more natural, although it may be very erroneous, than to attribute the cure of a disease to the last medicine that had been administered; the advocates even of amulets and charms* have been thus enabled to appeal to the testimony of what they call experience, in justification of their superstition.—Homœopathic effects have been chronicled as miracles, and cases which in truth and justice ought to be considered as most lucky *escapes*, have been triumphantly announced as skilful *cures;* and thus have medicines and practitioners alike acquired unmerited praise, or suffered from unjust censure. We have read of certain ceremonies performed in Spain to arrest the dangers of hail-storms; upon such occasions their saintships, Demetrius and Chelidonius, were propitiated, and with such extraordinary success, it is said, that after divers processions, lighting of candles, singing, chanting, and various other solemnities, the storm was sure to subside.

It should, moreover, be kept in mind, that two events may arise from a common cause, and be co-existent, and yet have not the most remote analogy to, or dependence upon, each other. It was a general belief at St. Kilda, that the arrival of a ship gave all the inhabitants *colds*. Dr. John Campbell took a great deal of pains to ascertain the fact, and to explain it as the effect of

* This species of delusion, from mistaking the *post hoc* for the *propter hoc*, always reminds me of the story of the Florentine quack, who gave the countryman six pills, which were to enable him to find his lost ass; the pills beginning to operate, obliged him to retire into a wood, where he found his ass. The clown soon spread a report of the wonderful success of the quack, who, in consequence, reaped an ample reward from the proprietors of strayed cattle.

effluvia arising from human bodies; the simple truth, however, was, that the situation of St. Kilda renders a north-east wind indispensably necessary before a stranger can land,—the wind, not the stranger, occasioned the epidemic.

Upon Mrs. Stephens offering her remedy for the stone to Parliament,* a committee of professional men was nominated to ascertain its efficacy; a patient with stone was selected, and he took the remedy; his sufferings were soon relieved, and, upon examining the bladder in the usual way, no stone could be felt: it was therefore agreed that the patient had been cured, and that the stone had been dissolved. Some time afterwards this patient died, and, on being opened, a large stone was found in a pouch formed by a part of the bladder, and which communicated with it. When the yellow fever raged in America, the practitioners trusted exclusively to the copious use of mercury; at first, this plan was deemed so universally efficacious, that, in the enthusiasm of the moment, it was triumphantly proclaimed that death never took place after the mercury had evinced its effects upon the system: all this was very true, but it furnished no proof of the efficacy of that metal, since the disease, in its aggravated form, was so rapid in its career, that it swept away its victims long before the system could be brought under mercurial influence, while in its milder shape it passed off equally well without any assistance from art.

Let us then, before we decree the honours of a cure to a favourite medicine, carefully and candidly ascertain the exact circumstances under which it was exhibited, or we shall rapidly accumulate examples of the fallacies to which our art is exposed. What has been more common than to attribute to the efficacy of a mineral water those fortunate changes of constitution that have entirely, or in great measure, arisen from salubrity of situation, hilarity of mind, exercise of body, and

* The grant of £5,000 to Joanna Stephens, for her discovery of certain medicines for the cure of the stone, is notified in the London Gazette of June, A. D. 1739.

regularity of habits, which have incidentally accompanied its potation. Thus, the celebrated John Wesley, while he commemorates the triumph of "Sulphur and Supplication" over his bodily infirmity, forgets to appreciate the resuscitating influence of four months' repose from his apostolical labours; and such is the disposition of the human mind to place confidence in the operation of mysterious agents, that we find him more disposed to attribute his cure to a brown paper plaster of egg and brimstone, than to Dr. Fothergill's salutary prescription of country air, rest, asses' milk, and horse exercise.* The ancient physicians duly appreciated the influence of such agents; their temples, like our watering-places, were the resort of those whom medicine could not cure, and we are expressly told by Plutarch that these temples, especially that of Esculapius, were erected on elevated spots, with the most congenial aspects; a circumstance which, when aided by the invigorating effects of hope, by the diversions which the patient experienced in his journey, and perhaps by the exercise to which he had been unaccustomed, certainly performed many cures. Upon this principle the bones of St. Anthony gained the credit which should have been attributed to the locality of his shrine, and the hospitality of his priests.† At Padua, rheumatics crawl on their knees around the altar tombs in the church of St. Justina, and believe by this devotion that their aches will be cured. There can be no doubt that the exertion made upon these occasions must frequently be beneficial. Beckford says, "You can have no conception of the ridiculous attitudes into

* Wesley's Journal, vol. xxix. 290—293.

† The name of St. Anthony seems to have been first associated with an epidemic disease, produced by deficient nourishment, and which prevailed in Dauphiné about the end of the twelfth century. An abbey dedicated to that saint had recently been founded at Vienne in that province, where his bones were deposited; and it was a popular opinion in that and the succeeding century, that all the patients who were conveyed to this abbey were cured in the space of seven or nine days,—a circumstance which the ample supply of food in those religious houses may satisfactorily explain.—*Bateman on Cutaneous Diseases.*

which they throw themselves, nor the difficulty with which they squeezed along, between the middle column of the tomb and those which surround it; no criminal in the pillory ever exhibited a more rueful appearance, no swine ever scrubbed itself more fervently, than those infatuated lubbers. I left them hard at work, taking more exercise than had been their lot for many a day." For the same reason, in the recommendation of a *watering-place*, something more than the composition of a mineral spring is to direct our choice. The chemist will tell us, that the springs of Hampstead and Islington rival those of Tonbridge and Malvern, that the waters of Bagnigge Wells, as a chalybeate purgative, might supersede those of Cheltenham and Scarborough, and that an invalid would frequent the spring in the vicinity of the Dog and Duck, in St. George's Fields, with as much advantage as the celebrated Spa at Leamington; but the physician is well aware that by the adoption of such advice, he would deprive his patient of those most powerful auxiliaries to which I have alluded, and above all, lose the advantages of the "*Medicina Mentis.*" On the other hand, the recommendation of change of air and habits will rarely inspire confidence, unless it be associated with some medicinal treatment; a truth which it is more easy and satisfactory to elucidate and enforce by examples than by precept—let the following story by Voltaire serve as an illustration.—"Ogul, a voluptuary, who could be managed but with difficulty by his physician, on finding himself extremely ill from indolence and intemperance, requested advice:—'Eat a basilisk, stewed in rose-water,' replied the physician. In vain did the slaves search for a *basilisk*, until they met with Zadig, who, approaching Ogul, exclaimed, 'Behold that which thou desirest. But my lord, continued he, 'it is not to be eaten; all its virtues must enter through thy pores: I have therefore enclosed it in a little ball, blown up, and covered with a fine skin; thou must strike this ball with all thy might, and I must strike it back again, for a considerable time, and by observing this regimen, and taking no other drink than rose-water for a

few days, thou wilt see and acknowledge the effect of my art.' The first day Ogul was out of breath, and thought he should have died from fatigue; the second he was less fatigued, and slept better: in eight days he recovered all his strength; Zadig then said to him, 'There is no such thing in nature as a basilisk! but *thou hast taken exercise and been temperate, and hast therefore recovered thy health!*'" But the medical practitioner may perhaps receive more satisfaction from a modern illustration; if so, the following anecdote, related by Sydenham, may not be unacceptable. That great physician having long attended a gentleman of fortune with little or no advantage, frankly avowed his inability to render him any further service, adding, at the same time, that there was a physician of the name of Robinson at Inverness, who had distinguished himself by the performance of many remarkable cures of the same complaint as that under which his patient laboured, and expressing a conviction that, if he applied to him, he would come back cured. This was too encouraging a proposal to be rejected; the gentleman received from Sydenham a statement of his case, with the necessary letter of introduction, and proceeded without delay to the place in question. On arriving at Inverness, and anxiously inquiring for the residence of Dr. Robinson, he found, to his utter dismay and disappointment, that there was no physician of that name, nor had been in the memory of any person there. The gentleman returned, vowing eternal hostility to the peace of Sydenham; and, on his arrival at home, instantly expressed his indignation at having been sent on a journey of so many hundred miles for no purpose. "Well," replies Sydenham, "are you in better health?"—"Yes, I am now quite well, but no thanks to you."—"No," says Sydenham, "but you may thank Dr. Robinson for curing you. I wished to send you a journey with some object of interest in view; I knew it would be of service to you; in going, you had Dr. Robinson and his wonderful cures in contemplation; and in returning, you were equally engaged in thinking of scolding me!" Had the patient been sent on a journey without the contemplation of some plausible object, the result would pro-

bably have been less satisfactory; we see, therefore, how much more sagacious was Sydenham's prescription than that of Herodicus under similar circumstances, for he sent his patients from Athens to Megara, with no other object than to touch the walls and return.

AMBIGUITY AND CHANGES OF NOMENCLATURE.

It has been already stated that we are to a great degree ignorant of the Simples used by the ancient physicians; we are often quite unable to determine what the plants are of which Dioscorides treats. It does not appear that out of the seven hundred plants of which his Materia Medica consists, more than four hundred are correctly ascertained; and yet no labour has been spared to clear the subject of its difficulties; Cullen even laments that so much pains should have been bestowed upon so barren an occasion.* The early history of botany presents us with such a chaos of nomenclature, that it must have been impossible for the herbalist and physician to have communicated their mutual lights; every one was occupied with disputes upon words and names, and every useful inquiry was suspended, from an inability to decide what plant each author intended; thus, for instance, the *Herba Britannica* of Dioscorides and Pliny, so celebrated for the cure of the

* Soon after the invention of the art of printing, the works of Dioscorides, Theophrastus, and Pliny, were published in various forms, and commentators swarmed like locusts. The eagerness with which this branch of knowledge was cultivated may be conceived, when it is stated that the Commentary of Matthiolus on Dioscorides, which was first printed in 1554, passed through seventeen editions, and that 32,000 copies had been sold before the year 1561; and he tells us in this work, that he received in its execution the assistance and reward of emperors,—kings,—electors of the Roman empire,—archdukes,—cardinals,—bishops,—dukes, and princes, "which," says he, "gives greater credit to our labours than anything that could be said." "In very many cases, however," says Dr. Pultney, "this learned commentator mistook the road to truth, and did but perplex the science he so industriously laboured to enlighten."

soldiers of Julius Cæsar on the Rhine, of a disease called "*Scelotyrbe*,"* and supposed to resemble our sea scurvy, remains quite unknown, notwithstanding the labours of our most intelligent commentators.† It seems also very doubtful whether the plant which we denominate *Hemlock* was the poison usually administered at the Athenian executions,‡ and which deprived Socrates, Dion, and Phocion of life. Pliny informs us that the word *Cicuta*, amongst the ancients, was not indicative of any particular species of plant, but of vegetable poisons in general. This is a circumstance to which I am particularly anxious to fix the attention of the reader: it is by no means uncommon to find a word which is used to express general characters, subsequently become the name of a specific substance in which such characters are predominant; and we shall find that some important anomalies in nomenclature may be thus explained. The term "Αρσενικον," from which the word *Arsenic* is derived, was an ancient epithet, applied to those natural substances which possessed strong and acrimonious properties; and as the poisonous quality of arsenic was found to be remarkably powerful, the term was especially applied to Orpiment, the form in which this metal more usually occurred. So the term *Verbena* (quasi *Herbena*) originally denoted *all those* herbs that were held sacred on account of their being employed in the rites of sacrifice, as we learn from the

* From σκελος, the leg, and τορβη, disorder.

† Turner, the father of English botany, was of opinion that it was the Polygonum Bistorta; Munting, a Dutch physician, that it was the Hydrolapathum Magnum, or Rumex Aquaticus, or Great Water Dock, an opinion which received the sanction of Ray. Others have supposed it to have been Polygonum Persicaria, and some have considered it as the Primula Auricula. This one example is adduced to show the mortifying uncertainty that involves the history of ancient plants.

‡ Meade thinks that the Athenian poison was a combination of active substances,—perhaps that described by Theophrastus as the invention of Thrasyas, which, it was said, would cause death without pain, and into which Cicuta and Poppy entered as ingredients. Whatever it might have been, it was evidently not very active, for the executioner told Socrates that its effects would be prevented by earnest dispute; and we are farther informed, that it was sometimes necessary to repeat the dose three or four times.

poets;* but as *one* herb was usually adopted upon these occasions, the word *Verbena* came to denote that particular herb, *only*, and it is transmitted to us to this day under the same title, viz. *Verbena*, or *Vervain*, and indeed, until lately, it enjoyed the medical reputation which its sacred origin conferred upon it, for it was worn suspended round the neck as an amulet. *Vitriol*, in the original application of the word, denoted *any* crystalline body with a certain degree of transparency (*Vitrum*); it is hardly necessary to observe that the term is now appropriated to a particular species: in the same manner, *Bark*, which is a general term, is applied to express *one* genus, and, by way of eminence, it has the article, *The*, prefixed, as *The* Bark: the same observation will apply to the word *Opium*, which, in its primitive sense, signified *any* juice, (οπος, *succus*) while it now denotes one species only, viz. that of the poppy; thus, there was formerly a class of medicines termed *Opiata*, into which the juice of the poppy never entered as an ingredient; for instance, *Opium Cyrenaicum* was the name given to assafœtida by some of the writers of the middle ages; and *Opoponax* was so called from οπος, and παναξ, the latter being the name of the plant from which it exuded. So, again, *Elaterium* was used by Hippocrates to signify various internal applications, especially purgatives of a violent and drastic nature,† (from the word Ελαννω, *agito*, *moveo*, *stimulo*,) but by succeeding authors it was exclusively applied to denote the active matter which subsides from the juice of the *wild cu-*

* "Verbenasque adole pingues, et Mascula Thura." *Virg. Eclog.* viii.

"Ex Ara hac sume Verbenas Tibi." *Terent. Andria.*

"Ara castis
vincta Verbenis."———*Hor. Od.* xi. *Lib.* iv.

It is a curious fact that in Tuscany the word *Vervena* is applied to denote *any* kind of slips, shoots, suckers, or bundles of plants, at this very day.

† "Hippocrati Elaterium medicamentum est quod per aloum expurgat." (Bed. in Theophras.)

The Elaterium of Dioscorides must have been a very different preparation from that of Hippocrates, and that of Theophrastus must have differed from both.

cumber. The word *Fecula*, in like manner, originally meant to imply *any* substance which was derived by spontaneous subsidence from a liquid, (*Fæx*, the grounds or settlement of *any* liquor); afterwards it was applied to *Starch*, which is deposited in this manner, by agitating the flour of wheat in water;* and lastly it came to denote a peculiar vegetable proximate principle, distinguished, like starch, by being insoluble in cold, but completely soluble in boiling water, and forming with it a gelitanous solution. This indefinite meaning of the term has created numerous errors in pharmaceutic chemistry; *Elaterium*, for instance, has been called a *Fecula*, and in the original sense of the word it is correctly so designated, inasmuch as it is procured from a vegetable juice by spontaneous subsidence, but, in the limited and modern acceptation of the term, it conveys an erroneous idea, for, instead of the active principle of the juice residing in *fecula*, it is a proximate principle, *sui generis*, upon which I have ventured to bestow the name of *Elatin*. For the same reason, much confusion has arisen from the word *Extract* having been applied *generally* to denote any substance obtained by the evaporation of a vegetable solution, and *specifically* to a peculiar proximate principle, which was considered by Fourcroy and Vauquelin to constitute the basis of all such products.† On the other hand, we find that many words which were originally only used to denote particular substances, have in the course of time become subservient to the expression of general characters; thus the term *Alkali*, in its original sense, signified that particular residuum which was obtained by *lixiviating* the ashes of the plant named *Kali;* but the word is now so generalized, that it denotes *any* substance possessed of certain chemical characters.

* Amylum, the starch of wheat, originally denoted a powder that was obtained without the operation of grinding, from α, not, and μολος, a mill: thus Dioscorides, Αμολον ὠνόμασαι διὰ τὸ χωρὶς μυλου κατασκεναζεσθαι· i. e. because it is procured without a mill.

† It has been described as a principle at first soluble in water, but rapidly absorbing oxygen, by which it acquires a brown colour, and becomes insoluble. Saussure, however, has shown that this change is not

Another source of ambiguity and error is the circumstance of certain plants having acquired the names of others very different in their nature, but which were supposed to possess a similarity in external character; thus our Potato,* (*Solanum Tuberosum*,) when it was first imported into England by the colonists in the reign of Queen Elizabeth, gained its appellation from its supposed resemblance to an esculent vegetable at that time in common use, under the name of the Sweet Potato (*Convolvulus Battatas*,) and which, like *Eringo Root*, had the reputation of being able to restore decayed vigour: thus Falstaff—

"Let the sky rain potatoes, hail kissing comfits, and snow eringoes."
Merry Wives of Windsor, Act V. *Scene* 5.

A similar instance is presented to us in the culinary vegetable well known under the name of the Jerusalem Artichoke, which derived its appellation in consequence of its flavour having been considered like that of the common artichoke; it is hardly necessary to observe that it has no botanic relation whatever to such a plant, it being an Heliotrope (*Heliotropium Tuberosum*.) The epithet *Jerusalem* is a curious corruption of the Italian term *Gira-Sole*, that is *turn-sun*, in English, or *Heliotrope* in Greek. This instance of verbal corruption is not solitary in medical botany. Castor Oil will suggest itself as another example; this oil, from its supposed efficacy in curing and assuaging the natural heat of the body, and in soothing the passions, was called by the French *Agnus Castus*,

owing to the acquisition of oxygen, but to the loss of hydrogen, the latter combining with the former to form water, and the relative quantity of carbon having been thus increased, will account for its insolubility and change of colour. To this brown extract Berzelius has given the name of *Apotheme*, i. e. *deposit*. It is very soluble in caustic potass, to which it imparts a deep brown colour.

* Gerard, in his Herbal (1597,) denominates it, by way of distinction, Potato of *Virginia*; and he recommends it to be eaten as a *delicate* dish, not as common food; indeed some time elapsed after its introduction before it became general, and it was cultivated as an article of diet in Ireland several years before it was common in England.

whence the inhabitants of St. Kitts in the West Indies, who were formerly blended with the French in that island, called it *Castor* oil. In some cases, again, a plant has received a modern name, compounded of two ancient ones; it appears from Pliny that the *Assarum* was not uncommonly confounded with the *Baccharis;* a name was accordingly bestowed upon it, which is a curious compromise of the question, for it is a compound of both, viz. *Assarabacca.**

In some instances the most alarming mistakes have occurred, from substances of a very different nature having been mentioned under similar names; *Arsenic*, for instance, has actually been inhaled,† together with the vapours of frankincense, myrrh, and those of other gums, during a paroxysm of asthma! a practice which arose from the practitioner having confounded the Gum Juniper, or *Vernix* of the Arabians, which was prescribed for fumigations under the name of *Sandarach*, with the Σανδαρακη of Aristotle, and which was a sulphuret of arsenic. The gum which we know at the present day under the name of *Sanguis Draconis*, or *Dragon's Blood*, was called by the ancient Greeks Κινναβαρι, a term which has been incorrectly transferred to a sulphuret of mercury, for no other reason than because this mineral has the same red colour as the gum.

The ancients, not being acquainted with the distinction be-

* MM. Thiebaud and Tenore have recognized in the *Asarum* the Baccharis of Virgil, with which crowns were formerly constructed.

† The inhalation of the fumes of *Orpiment* is a practice attributed to Galen; and one of the most distinguished of his disciples, Rhazes, recommends it to be inhaled by consumptive patients, in combination with stimulant and resinous substances, such as *Storax, Myrrh, Galbanum*, and *Aristolochia root.* Bennet recommends the same practice in such cases. Willis informs us that a similar custom prevailed among certain empirics of his day, and asserts that they took such pieces of carpet as were dyed with *Orpiment*, and cut them into small pieces, exposed them to heat, and, by means of an inverted funnel, made the patient inhale the vapour. Sir Alexander Crichton seems disposed to believe that such applications might prove useful, by changing the action of any ulcer to which they were applied.

tween aluminous and calcareous earths, employed *creta* as a term to denominate every white fine earthy powder, whence have arisen much confusion and numerous errors. Although the term *Alumen* frequently occurs in their writings, it is supposed to refer to *sulphate of iron*, and not to the triple salt which now bears the name of *Alum*.

The advanced state of Botanical Science will prevent the recurrence of those doubts and difficulties which have formerly embarrassed the history of vegetable remedies, by furnishing a strictly philosophical language founded upon natural structure, and therefore necessarily beyond the control of opinion; while the advancement of chemical knowledge, by enabling us better to distinguish and identify the different substances we employ, will also materially assist in preventing the confusion which has formerly oppressed us.

And with reference to this subject, I am naturally led to offer some remarks upon the various changes which have taken place from time to time in our chemical nomenclature, as they regard pharmacy generally, and the pharmacopœia more particularly.

By those who have skimmed along the stream of science, and watched the bursting bubbles upon its surface, the successive and rapid changes to which chemical language has been subjected have been regarded not only as evidence of the instability of the science itself, but of its utter unfitness as the basis of pharmaceutical nomenclature. A little reflection, however, will dispose us to take a much more encouraging view of the question, and to regard the frequency of such changes as a proof of the rapidity with which the science has advanced. Chemical nomenclature is an ingenious contrivance to express the nature or composition of bodies, in accordance with the best established opinions; in order, therefore, that it may continue faithful to its purpose, it must necessarily change with the accumulation of new facts, and the consequent expansion of knowledge.

> " Si forte necesse est
> Indicis monstrare recentibus abdita rerum;
> Fingere cinctutis non exaudita Cethegis
> Continget; dabiturque licentia sumpta pudenter.
> Et nova factaque nuper habebunt verba fidem."

This cannot be denied; but then it is urged that such fluctuations, however essential to the philosopher, are extremely embarrassing and vexatious to the pharmaceutist and medical practitioner, and that " the more decorous dress of science has been dearly purchased at the cost of being compelled to follow the changing fashion of the day." Thus CORROSIVE SUBLIMATE was considered a *muriate* or *oxymuriate* of mercury, until Sir H. Davy established his theory of chlorine, and it then became a *bichloride*. CALOMEL* has, by turns, been considered as a *muriate*, *submuriate*, and *chloride*. If we examine the nomenclature of our salts, we shall perceive that the same term has, in a few years, actually undergone an essential change in its meaning; thus, for instance, the *Carbonate of Soda*, or of *Potass*, of the Pharmacopœia of 1824, was a very different *compound from that of* 1836; *the carbonate of* the latter being the *sub*-carbonate of the former; such a change in name, however, was the consequence of enlarged views, and was therefore indispensable; the terms *sub* and *super*, when prefixed to the generic name of a salt, originally denoted an excess of acid or of base, as indicated by the predominance of

* Calomel.—There is some doubt respecting the original meaning of this word: it literally signifies *fair, black*, καλος, μελας. Sir Theodore Mayerne is said to have given the name to it, in consequence of his having a favourite black servant who prepared it; but is it not more probable that its name was derived from the change of colour which it undergoes from *black* to *white* during its preparation? Another explanation has been also given, viz. quòd *nigro* humori sit *bonum*—a *good* (καλος) remedy for *black* (μελας) bile. This theory derives much support from the black appearance of the stools, which is usually produced by the use of calomel, and which was erroneously attributed to the searching and efficacious nature of the purgative. The calomel of Riverius was a compound of *Mercurius dulcis* ℈j and *Scammoneæ* gr. vij. and Mr. Gray thinks that the term Calomel was first applied to this remedy, as being a mixture of a white and dark coloured powder.

its acid or alkaline qualities; but these terms have been discarded from our vocabulary, and in their place we have a more perfect nomenclature,* founded upon the theory of proportionals, or the atomic doctrine, which not only expresses the excess of the acid, or that of the base, but the exact proportion of such excess, without reference to its sensible qualities. I am not prepared to say that the adoption of arbitrary names, having no reference to chemical composition, might not have been attended with several advantages, more especially that of preventing the necessity of changes during the progress of science; but, on the other hand, let us not overlook the evils inseparable from such a plan, as, for instance, that of employing terms which in the progress of time would become obsolete, and perfectly unintelligible in foreign countries. Let the reader wade through the prescriptions of the older writers, and he may well fancy himself in the land of Shinar; whereas, by adopting the recognized language of science, whatever may be its future revolutions, the articles of the materia medica will be readily identified in every age and country. As a member of the London Pharmacopœia committee, I can assure the profession that the important question of nomenclature was not flippantly argued, nor hastily decided; each difficulty was searchingly examined, collectively and individually, by those to whom it was referred; and it was unanimously decided, that having

* To a salt formed of one equivalent or atom of the acid to one of the base, its generic name is applied without any addition; as *Potassæ Carbonas, Potassæ Sulphas, Potassæ Tartras;* but if two or more equivalents of the acid are united to one of the base, their number is expressed by Latin numerals, as *Potassæ* Bi-*Carbonas—Potassæ* Bi-*Sulphas—Potassæ* Bi-*Tartras.* Where the relation of acid to the base is as 1 to 1½, or 2 to 3, the term *Sesquin* is prefixed as the indication; thus *Ammoniæ* Sesqui-*carbonas,* Sodæ Sesqui-*carb.* &c. In cases where the base preponderates, and one equivalent of acid is united to two, three, or more equivalents of base, instead of the Latin, the *Greek* numerals are prefixed; for example, *Plumbi* Di-*acetas, Quinæ* Di-*sulphas, Bismuthi* Tris-*nitras.* The same system applies to Oxides, Sulphurets, Chlorides, &c.; thus *Hydrargyri Oxydum, Hydrarg.* Bin-*oxydum, Ferri* Sesqui-*oxydum, Hydrarg. Chloridum, Hydrarg.* Bi-*chlorid.*, &c.

once abandoned trivial for scientific terms, it was quite impossible to retrograde. Had we arrived at a different conclusion, *Calomel*, *Corrosive Sublimate*, and a few other trivial names, might have passed muster readily enough; but how could we have consistently dealt with the more recently discovered bodies, such as the compounds of *Iodine*, which are known only by names denoting their composition. We must have produced a patchwork that would have very justly excited the censure of the scientific world.* But, whatever doubts may have remained as to the soundness of this judgment, they must certainly have been fully dispelled by the more recent publication of the Pharmacopœia of the Edinburgh College. If scientific attainments of the highest order could have surmounted the difficulties with which the subject is surrounded, the distinguished authors of this standard work of Scotland would have unquestionably achieved their laudable object; but, notwithstanding the talents put in requisition, the result is an entire failure, and, as far as the College of London is concerned, will, I trust, put this long-contested question for ever at rest.

In its preface they express an apprehension that "the practitioner will not submit much longer to the constant fluctuations which have been for some time forced upon them in pharmaceutic nomenclature;" and they add, "we have done our best to put a stop to this evil; the result has been necessarily a patchwork, of which we cannot boast, but which the public will probably receive in consideration of its convenience." It is indeed a patchwork, not even consistent in its inconsistencies —a monster whose several parts bear no harmonious relation with each other. It may be readily shown to be a scheme which has introduced new evils, without having in the smallest degree abated that for which they have abandoned "the decorous dress of science." If, in order to put a stop to the mischief inseparable from perpetual changes of name, they had thought

* These remarks were published in the supplement to the eighth edition of the Pharmacologia, long before the appearance of the last Edinburgh Pharmacopœia.

it expedient to return to the trivial terms, *Lithargyrum*, *Calomelas*, *Sublimatus Corrosivus*, *Unguentum Citrinum*, *Præcipitatum Album*, &c., they should certainly have carried out their plan, so as to have included *Cremor Tartari*, *Cinnabaris Factitia*, *Acidum Prussicum*, (the original name of Scheele) *Tartarum Emeticum*, *Sal Commune*, *Sal Ammoniaci*, &c., instead of bestowing upon them, respectively, the chemical names of *Potassæ Bi-tartras*, *Hydrargyri Sulphuretum Rubrum*, *Acidum Hydrocyanicum*, *Antimonium Tartarizatum*, *Sodæ Murias*, *Ammoniæ Murias*, &c., which are of course obnoxious to all those fluctuations they so loudly denounce.

It may, perhaps, have been their intention, in adopting these terms, to vote them as permanent and unalterable, notwithstanding any scientific changes that may hereafter take place; but if chemical names be employed at all, they should correctly correspond with the prevailing theory of the day, or, at all events, be chronologically consistent with each other; to act otherwise, would be to perpetuate and diffuse error, and to arrest the progress of improvement. It may possibly, under particular circumstances, be expedient to withhold truths, but it can never be right to disseminate fallacies. One of the most important discoveries of our times has been that of the relations of *Chlorine* and *Iodine* to metallic bases, so as to form chorides; thus, we have *Chloride of Sodium*, and *Iodide of Potassium*; but the Edinburgh Pharmacopœia, while it has retained the latter, has so far violated the logic of nomenclature as to designate the former the *Muriate of Soda*. In turning to this article in the Materia Medica, we shall find it inserted as "*Sodæ* Murias, *Salt, Impure Commercial Chloride of Sodium:*" thus trade is made to respect the science which the pharmaceutist rejects.

Attempts have occasionally been made to compromise the question of scientific nomenclature, and to impose names upon articles, which, while they conveyed a general chemical expression of their composition, avoided everything like accurate definition; as, for instance, *Ferrum Ammoniatum*, and *Cuprum Ammoniatum*. The term "*Ammoniated*," as thus applied, would

denote that each metal was placed in the same chemical relation to ammonia; whereas, in the one case the compound is an ammonio-*chloride*, and, in the other, an ammonio-*sulphate*.

I am by no means disposed to advocate the hasty adoption of new terms, or the subtle refinements of composite nomenclature; and if the dates of the successive pharmacopœias of London be examined with reference to the chemical nomenclature of the corresponding periods, it will appear that new terms have never been rashly or hastily adopted. We have advanced in the track of the chemist, but always with caution; we have followed, "*haud passibus æquis*," our pioneer in his nomenclatural march. Wherever any doubts exist, the pharmaceutist is the last person who should become arbiter; he is to await the issue in unobtrusive silence, and take care that the language of pharmacy partakes of the same neutrality. With such precautions, as our nomenclature now stands, there is but little chance of future disturbance.

Objections have been taken to the language in which our pharmacopœias have been hitherto written. It has been asked, "for what purpose this national work is written in a dead language, not spoken in purity by any nation on the earth?" If not spoken, it is written and understood throughout the civilized world, and that cannot be said of any other language. An invalid travelling through many parts of Europe might die before a prescription written in English could be interpreted. But the truth is, that there unfortunately exists in the under-educated members of our profession a discontented spirit, which leads them to disparage, and carp at, whatever bears the stamp of learning;* and it is greatly to be regretted that the College

* In adverting to this fact in my Supplement to the eighth edition, I gave great offence to a writer in the Edinburgh Medical and Surgical Journal by the following remark, and accompanying quotation from Palladius: "It is the character of the mischievous goose, '*improbus anser*,' to tear up by the root every thing it approaches, '*et morsu lædit et stercore*.' Perhaps cunning, more than folly, should be attributed to a class of persons who attempt to raise themselves by depressing everything around

of Edinburgh, to use a popular expression, should have so far yielded to this "*pressure from without*," as to have published their Pharmacopœia in the English language; or, I ought rather to say, their directions for compounding its several officinal preparations, for be it known that the articles of the materia medica still retain a Latin designation. And here we cannot but remark an inconsistency as grievous as that which disfigures their nomenclature. In every former pharmacopœia, the list of articles in its materia medica has been understood as being an enumeration of the drugs to be employed for the preparation of the officinal compounds; and, consequently, it has been the invariable rule, that the names of such ingredients as are introduced into the formula should exactly correspond with, and faithfully repeat, those of the same substances as they stand in the materia medica; but in the work before us, the articles appear in Latin in the list, and in English in the formulæ; and in some instances they differ even in their chemical denomination. In the formula for the preparation of "AMMONIÆ AQUA, et AMMONIÆ AQUA FORTIOR, it is said, "Take of muriate of ammonia thirteen ounces," and so on; but in the very next formula for the preparation of AMMONIÆ CARBONAS, instead of muriate of ammonia, the direction is, "Take of *sal-ammoniac* one pound;" and if we turn to the materia medica, the term *sal-ammoniac* is not to be found: there is Ammoniacum, the English of which we are there told is *Ammoniac;* and this occurs in a pharmacopœia that professes to provide a luminous nomenclature. Again, as if the spirit of inconsistency were still unappeased, the editors, without any obvious reason, introduce the name of an ingredient sometimes in Latin, and sometimes in English; thus, for the preparation of "ANTIMONII SULPHURETUM PRÆCIPITATUM," we have, "Take of *solution of potash*," &c., while, for that of "LINIMENTUM AMMONIÆ, we are directed to

them, and that I might therefore have more aptly compared them to the fox in the fable, who, being without a tail, would persuade others to cut off theirs as a useless burthen.

"Take of olive oil two fluid-ounces; *aqua ammoniæ* one fluid ounce." In the following instance, both English and Latin are blended together; in the class of alkalies there is a preparation termed "AMMONIÆ AQUA FORTIOR," but when it is introduced in the formula for preparing the "FERRI OXIDUM NIGRUM," it is designated as *Strong* Aqua Ammoniæ. In making these observations, my only motive has been to show how utterly unsuccessful must be any plan of reform like that adopted by the Edinburgh College, and that the course pursued by the London College of Physicians is the one best calculated to furnish a correct, consistent, and intelligible Pharmacopœia.

THE PROGRESS OF PHYSIOLOGICAL BOTANY.

It has been already observed that from botanical science we have derived a philosophical language, by which we are enabled to describe the structure and habits of plants with brevity and perspicuity; but we are moreover indebted to that science for another service, no less important to the successful investigation of the vegetable articles of our materia medica,—that of throwing into well-defined groups such plants as possess obvious natural affinities, and which will be found, at the same time, to present certain medicinal analogies; for, as a general rule, we may admit the axiom, "*Quæ genere conveniunt, virtute conveniunt.** Thus the

* Dr. Blair thinks that the ancients were led, in many instances, by such comparisons to ascribe similar virtues to plants; there does not, however, appear to be a trace of what may be called system in the writings of Theophrastus, Dioscorides, or Pliny. Cæsalpinus was the father of botanical system, and he was probably the first who suggested the idea that the virtues of plants were discoverable by their structure and alliance to each other. In his preface to his work, "De Plantis," he says, "Quæ enim generis societate junguntur, plerumque et similes possident facultates." This idea was pursued by Petiver, an apothecary in the city of London, a name well known in the annals of Botany; there is

Umbelliferæ which grow on dry ground are aromatic, whilst the aquatic species are among the most deadly poisons. The *Cruciform* plants are aromatic and acrid in their nature, containing essential oils, (hence the peculiar smell of cabbage-water, &c.,) which are obtainable by distillation; and Linnæus asserts that "among all the *Leguminous* or *Papilionaceous* tribe there is no deleterious plant to be found:" this, however, is not exactly true. Some of the individuals in these natural orders, although very nearly related, do nevertheless possess various and even opposite qualities; in the leguminous tribe above mentioned, which is as consistent as any one we possess, we have the *Cytisus Laburnum*, the seeds of which are violently emetic, and those of *Lathyrus Sativus*, which have been supposed at Florence to soften the bones and cause death.

In the subdivision even of a genus there is often a remarkable difference in the properties of the species; there are, for instance, *Solanums*, *Lettuces*, *Cucumbers*, and *Mushrooms*, both esculent and poisonous. The *Digitalis* or *Foxglove*, and the *Verbascum*, or common *Mullein* of our fields, are included in the same natural family, and yet the one is as active as the other is mild in its effects; the plants of the natural family of *Contortæ* abound with a highly acrid milky juice, but Dr. Afzelius met with a shrub of this order at Sierra Leone, the milk of whose fruit was so sweet, as well as copious, as to be used instead of cream for tea; this is certainly what no one could have guessed from analogy. The same individual will vary from culture, or other circumstances, as much as any two plants which have no botanic affinity; the chamomile,

a paper by him on this subject, in the twenty-first volume of the Philosophical Transactions, entitled, "Some attempts to prove that herbs of the same make and class, for the generality, have the like Virtue, and tendency to work the same Effects." Dr. Murray has adopted an arrangement founded upon natural character in his celebrated work entitled, "Apparatus Medicaminum." Gmelin and Jussieu have supported the same opinion with regard to these analogies; and Decandolle has published a work upon the subject, entitled "*Essai sur les Propriétés Médicales des Plantes.*"

Anthemis Nobilis, with which we are well acquainted, may have its whole disk changed, by cultivation, to ligulate white florets, destitute of medicinal properties. But what is more embarrassing, the different parts of the same plant have often very different powers; a fact which is beautifully exemplified in the *Podophyllum Peltatum*, or May-apple, the *leaves* of which are poisonous, the root powerfully cathartic, and the *fruit* agreeably esculent; so the leaves of the *Jatropa Manihot* are employed as a common esculent, while its root secretes a most virulent poison; but we need not seek further for an example than the fruit of the lemon, the juice of which is *acid*, its seeds *bitter*, and its *rind aromatic;* or in the poppy, the seeds of which, and the capsule which covers them, are endowed with properties of the most opposite characters. In some instances it happens that the energy of a plant is concentrated in one particular part, and that all the rest is absolutely inert; thus the root of the *Convolvulus Scammonia* is the only portion of that plant which possesses any medicinal quality;* and the tree which yields the drastic *Camboge* presents at the same time an esculent fruit, which is eaten by the natives with as much impunity as the orange. M. Berthonet has recorded a remarkable instance of the harmless quality of the sap in the interior of a plant, whose bark is filled with a milky proper juice of a poisonous nature. He describes the natives of Teneriffe as being in the habit of removing the bark from the *Euphorbia Canariensis*, and then sucking the inner portion of the stem in order to quench their thirst, this part containing a quantity of limpid and non-elaborated sap, (Henslow, Botany,) yet, notwithstanding all these difficulties, botany is capable of furnishing us with analogies which will lead to important conclusions with respect to the medicinal properties of different vegetables.

There is also a remark which is made by Sir John Herschel, which appears to me to be well worthy of attention, as being

* Russell's Nat. Hist. of Aleppo.

applicable to the subject under discussion. "It is," says he, "of consequence to distinguish between cases in which there is a real opposition of quality, or a mere diminution of intensity in some quality susceptible of degrees, till it becomes imperceptible; and he illustrates his proposition by stating that between transparency and opacity there would, at first sight, appear a direct opposition; but, on nearer consideration, when we perceive the gradations by which transparency diminishes in natural substances, we shall see reason to admit that the latter quality, instead of being the *opposite* of the former, is only its extreme lowest degree." Now, to apply this proposition to the subject under discussion, we may get rid of some serious anomalies; for instance, the aroma of the wholesome plants of the umbelliferous tribe is not a quality opposed to that of the poisonous tribe, but only the lowest grade of one and the same property. Cultivation and climate then, it would appear, do not reverse the qualities of plants, but merely change the intensity of them.

The system of Linnæus, although in a great degree artificial, corresponds in a surprising manner with the natural properties of plants; thus a plant whose *calyx* is a double valved *glume*, with three *stamina*, two *pistils*, and one *naked seed*, bears seeds of a farinaceous and nutritious quality; a flower with twelve or more *stamina*, all of which are inserted in the internal side of the *calyx*, will furnish a wholesome fruit; whereas a plant whose flower has five *stamina*, one *pistil*, one *petal*, and whose fruit is of the *berry* kind, may at once be pronounced as poisonous.

It is also in a great degree true that the sensible qualities of plants, such as *colour*, *taste*, and *smell*, have an intimate relation to their properties, and may often lead by analogy to an indication of their powers; we have an example of this in the dark and gloomy aspect of the *Luridæ*, which is indicative of their narcotic and very dangerous qualities, as *Datura*, *Hyoscyamus*, *Atropa*, and *Nicotiana*. *Colour* is certainly in many cases a test of activity; the deepest of coloured flowers—the *Digitalis*,

for example, are the most active, and when the leaves of powerful plants lose their green hue, we may conclude that a corresponding deterioration has taken place with respect to their virtues; but Linnæus ascribed too much importance to such an indication, and his aphorisms are unsupported by facts; for instance, he says, "Color pallidus *insipidum*, viridis *crudum*, luteus, *amarum* ruber, *acidum*, albus *dulce*, niger *ingratum*, indicat."* A peculiar heavy odour, which is well known, but is with difficulty defined, is a sure indication of narcotic properties. Bitterness, when not extreme, denotes a tonic quality, which will stimulate the stomach and intestines, and promote the process of digestion. When the bitterness is more intense and pungent,† as in *Aloes*, *Colocynth*, *&c.*, we may infer that such substances will produce a more active effect upon the *primæ viæ*, and that catharsis will follow their administration.

Botanical like human physiognomy may frequently afford an insight into character, but it is very often a fallacious index. With regard to the indications of *smell* and *taste*, it may be observed that in the examination of an unknown substance we instinctively apply to these senses for information respecting its properties. It is certainly reasonable to suppose, that those bodies which produce upon the organs of taste a sensible, astringent, or pungent effect, may occasion an impression, corresponding in degree, upon the stomach or intestine, which are but an extension of the same structure. But what numerous exceptions are there to such a law? Nay, some of the most poisonous substances affect in a very slight degree the organs of taste, especially those that belong to the mineral

* The student will find an interesting dissertation upon this subject in a work, entitled "L'Histoire Naturelle de Médicamens." Par J. J. Virey. 1820.

† Lord Bacon attributes the operation of purgatives to three causes, viz. 1, to *extreme bitterness*, as in Aloes; 2, to *loathsomeness and horrible taste*, as in Agaric and black Hellebore; and 3, to *a secret malignity*, as in Antimony, &c.

kingdom, as *Arsenious Acid, Oxyd of Antimony, Calomel, &c.* yet some of these are, perhaps, but apparent exceptions, depending upon the degree of solubility which they possess, in consequence of which their energies are not developed until they have traversed a considerable portion of the mucous surface. Nor ought it to be forgotten, that cultivation and artificial habits may have blunted the natural susceptibility of our organs, and in some instances changed and depraved their functions: certain qualities, for instance, are so strongly connected with each other by the chain of association, that by presenting only one to the mind, the other links follow in succession.* It has been remarked, that persons in social life are more affected by vegetable odours, while the savage smells better the putrid and fetid exhalations of animal bodies:† thus the people of Kamskatcha did not smell the perfume of a vegetable essence, (*Aqua Melissæ*,) but they discovered by their olfactory sense a rotten fish, or a stranded whale, at a considerable distance.‡ There is no sense more under the dominion of imagination, or more liable to be perverted by education, than those of taste and smell; we are also liable to form unjust pre-

* This might be illustrated by the recital of numerous fallacies to which our most simple perceptions are exposed from the powers of association; but I will relate an anecdote, which in my mind elucidates the nature and extent of such fallacies more strikingly than any example which could be adduced. Shortly after Sir Humphry Davy had succeeded in decomposing the fixed alkalies, a portion of *Potassium* was placed in the hands of one of our most distinguished chemists, with a query as to its nature: the philosopher, observing its aspect and splendour, did not hesitate in pronouncing it to be metallic; and uniting at once the idea of weight with that of metal, the evidence of his senses was even insufficient to dissever ideas so inseparably associated in his mind, and, balancing the specimen on his fingers, he exclaimed, "It is certainly metallic, and *very ponderous.*" Now this anecdote is not related in disparagement to the philosopher in question. Who could have been prepared to meet with a substance so novel and anomalous as to overturn every preconceived notion? —A METAL SO LIGHT AS TO SWIM UPON WATER, AND SO INFLAMMABLE AS TO CATCH FIRE BY THE CONTACT OF ICE!

† Virey, "Essai d'Histoire Naturelle et Physicolog. sur la Perfectibilité de l'Homme."

‡ Second Voyage of Captain Cook, vol. iv.

judices from the indications of colour: for particular colours, from the influence of hidden associations, are not unfrequently the exciting cause of agreeable or unpleasant impressions. I have known a person who regards green food, if it be of an animal nature, with unconquerable aversion and disgust: indeed an idea of unwholesomeness has not unfrequently been attached to this colour, without the least foundation of truth; the bones of the Gar fish, or Sea Needle, (*Esox Helone*,) have been deemed unwholesome from the circumstance of their turning green on being boiled, although not a single instance can be adduced in which that fish ever occasioned any harm. I have met with persons who have been made violently sick from eating the green part of the oyster;* an effect which can have no other cause than that of unjust prejudice; these examples are sufficient to show with what caution such indications respecting the medicinal qualities of bodies are to be received.

A very ingenious essay (which was rewarded, in 1827, by the prize offered by Dr. Duncan to his class) by Mr. Greeves, of Nottingham, has been published in the Edinburgh New Dispensatory. Its merits are such as to deserve particular mention in this place. The author proposes to classify the articles of the Materia Medica according to the taste and smell by which each substance is distinguished; and, in order to accomplish such an object with any degree of accuracy, it became necessary that he should in the first place unfold and define, with more precision than had hitherto been observed, the characters and distinctions of primary tastes and smells. In the

* The green colour of oysters is sometimes an operation of nature, but is more generally produced by art, by placing them in situations where there is a green deposit from the sea, which appears to consist of the vegetating germs of marine *confervæ and fuci*, and which impart their colour to the oysters. For this object the Dutch formerly took oysters from beds on our coasts, and deposited them on their own. *Native* oysters transported into the Colchester beds soon assume a green colour. It is unnecessary to refute the popular error which attributed this change of colour to the operation of copper.

fulfilment of this intention he ultimately refers all tastes to seven primary species, viz. the *sweet*, *bitter*, *alkaline*, *acid*, *saline*, *camphreous*, and *spirituous*. In like manner he also refers all smells to seven species, viz. the *acidulous*, *spirituous*, *camphreous*, *fragrant*, *somniferous*, *fœtid*, and *alkaline*. In this essay the various sources of fallacy are investigated with considerable talent, and the effects of them in perverting our judgment, and in sustaining an erroneous nomenclature, are illustrated by some very striking examples. For instance, the taste, denominated *nauseous*, is a complex sensation, for it not only comprehends a *specific* sensation of gustation, but also a sympathetic *common* impression (or sensation) in the stomach, consisting in a disposition to vomit. The *acrid* taste offers another example of a complex taste; it consists of a specific impression or flavour (generally a compound of the bitter class) and a common impression of heat, perceived by the sense of touch of the organ of gustation. Besides the sensation of heat, the function of touch, possessed by the organ of tasting, disguises flavours in another manner: we have, for instance, substances which impress a sensation of constriction, corrugation, or roughness,—such are galls, port-wine, and some acids.

"Another source of error in the discrimination of tastes is the confounding them with smells. Of this there is a remarkable example in those substances which are called *Aromatics*, which, it is now well understood, derive their peculiar qualities from their smell."

In treating the subject of smells, the author evinces the same philosophical perspicuity. He points out the perplexity of the subject, in consequence of the numerous alliances and associations by which it is embarrassed.

In the second division of his essay he proceeds to arrange the Materia Medica according to the qualities of taste and smell, excluding, as far as possible, all the foreign agencies by which they may be modified; and it is not a little remarkable that this method of arrangement should bring together those substances which possess common physiological properties.

In relation to the subject of odour, Professor Liebig makes the following interesting remarks. "We know that most of the blossoms and vegetable substances which possess a smell, owe this property to a volatile oil existing in them, but it is not less certain, that others emit a smell only when they undergo change or decomposition. The oil of the berries of the elder tree, many kinds of oil of turpentine, and oil of lemons, possess a smell only during their oxidation or decay. The same is the case with many blossoms; and *Geiger* has shown, that the smell of musk is owing to its gradual putrefaction and decay. It is also probable that the peculiar odorous principle of many vegetable substances is newly formed during the fermentation of their saccharine juices. At all events, it is a fact that very small quantities of the blossoms of the violet, elder, linden, or cowslip, added to a fermenting liquid, are sufficient to communicate a very strong taste and smell, which the addition of the water distilled from a quantity a hundred times greater would not effect." The practical importance of these observations will be apparent to the pharmaceutist; they will enable him to explain phenomena hitherto obscure and unintelligible, and perhaps lead him to the invention of new or improved processes.

THE INFLUENCE OF SOIL, CULTURE, CLIMATE, AND SEASON.

The facts hitherto collected upon this subject are so scanty and unsatisfactory, that I introduce the consideration of it in this place, rather with a wish to encourage inquiry, than with any hope of imparting additional information. In this investigation much difficulty arises from our inability to appreciate the exact degree of influence which is due to each of these circumstances, separately or conjointly, in modifying the nature of vegetable bodies. There can be little doubt but that soil, cul-

ture, climate, and season,* may each, and all, materially determine the active properties of a medicinal plant; while the two latter of these causes may as essentially change the type and character of a disease, and modify the vital susceptibility of the patient; for instance, the natives of the south of Europe do not bear bleeding, and other modes of depletions, so well as those of the north. This must be admitted to its full extent, or it will be extremely difficult to explain the contradictory and even opposite opinions, and to reconcile the conflicting testimonies of the physicians of different countries, with respect to the efficacy of the same remedy, in similar diseases.

The Influence of Soil may be exemplified by many well-known facts; thus, strongly-smelling plants lose their odour in a sandy soil, and do not again recover it by transplantation into a richer one; a fact upon which Rozier founded his proposal for the improvement of rape oil; so, again, no management could induce the *Ricotia Ægyptiaca* to flower, until Linnæus suggested the expediency of mixing clay with the earth in the pot; *Assafœtida* is one of those plants that vary much according to station and soil, not only in the shape of the leaves, but in the peculiar nauseous quality of the juice which impregnates them, and Dr. Woodville states that it is frequently so modified that the leaves are eaten by goats. Gmelin informs us, on the authority of Steller, that the effects of the *Rhododendron* have been found to vary materially according to the "*solum natalé;*" for example, that produced in a certain spot has proved uniformly *narcotic*, that in another, *cathartic*, while a sense of suffocation has been the only symptom occasioned by a third. By cultivation and luxuriant growth the medicinal powers of the *Aconite* are also considerably impaired.

That the earthy elements of a soil should greatly influence the chemical composition and medicinal powers of a plant may

* A very ingenious dissertation has been published by M. Virey, on the "Degeneration of Plants in Foreign Soils," which, he says, may depend upon 1. *climate* and *station;* 2. *nutriment;* 3. *culture;* 4. *factitious mutilation;* 5. *hybrid generation.*

be readily imagined; De Saussure and Berthier have proved it by their analyses, and Professor Liebig has proposed a theory which will go far to explain the fact. As a general proposition it may be stated that the presence of alkaline bases are essential to the due developement of a plant, and that when roots do not find their more appropriate base in sufficient quantity, they will take up more of another; but what is more important, the peculiar organic bases are found to vary in an inverse proportion with the fixed or mineral bases; a maximum of the former corresponding with a minimum of the latter, as must necessarily be the case, if they mutually replace one another according to their equivalents; and so also with regard to the acids with which they exist, so as to form salts. In all the species of *Cinchona*, kinic acid is found; but the quantity of *Quina*, *Cinchonia*, and *Lime* which they contain, is most variable. We also know that different kinds of opium contain *meconic* acid, in combination with very different quantities of *narcotina*, *morphia*, *codeia*, &c., the quantity of one of these alkaloids diminishing on the increase of the others. Thus, the smallest quantity of *morphia* is accompanied by a maximum of *narcotina*. Robiquet did not obtain a trace of *meconate of lime* from 300lbs. of opium, whilst in other kinds the quantity was very considerable, (*Ann. de Chim.* liii. p. 425,) but in the former case there was not an absence of acid, for the meconic was replaced by the sulphuric acid. If then it be found that an organic may be replaced by an inorganic acid, we must admit the probability of this substitution taking place in a much higher degree in the case of the inorganic bases. If we entirely cut off the supply of inorganic bases, as happens when potatoes are grown in cellars, a true organic alkali, called *solanina*, of a very poisonous nature, is formed in the sprouts which extend towards the light, while not the smallest trace of such a substance can be detected in the roots, herbs, blossoms, or fruits of potatoes grown in fields. Thus, then, may we easily understand how the soil may influence the composition and medicinal efficacy of a plant. Rhubarb, as grown in England, will differ greatly in its purgative qualities,

according to the soil in which it may have been cultivated; that produced in a dry gravel being more efficacious than that reared in a clayey one. The influence of soil upon the composition of the grape is still more striking, for its juice, according to its place of growth, not only differs in the proportion of free acid, but also in the quantity of sugar dissolved in it. *Climate* also produces a powerful impression upon vegetable as well as animal life; it is probable that in southern countries some vegetables possess more energetic properties than in northern climes. The history of opium would appear to countenance this opinion, but we must here repeat that it is very difficult to discriminate between the influences of soil and climate, until the chemist has furnished us with farther evidence for our judgment. Egypt certainly produces a stronger *opium* than any of the countries on the north side of the Mediterranean; France, than England or Germany, and Languedoc, than the northern parts of France; while Smyrna, Natolia, Aleppo, and Apulia, furnish a juice far more narcotic than Languedoc; so again, *senna*, by transplantation from Arabia to the south of France, (Provence,) assumes a marked change in its physiognomy and virtues; its leaves are more obtuse, and its taste less bitter and nauseous than the pointed leaf variety, while its effects will be found to be less purgative. *Cruciform* plants degenerate within the tropics, but acquire increased energies, as *antiscorbutics*, in cold regions; the *menthæ* have not so penetrating an essential oil in the south of Europe as in England and in the north of France. Dr. Carter, in his account of the "*Principal Hospitals of France, Italy, and Switzerland*," tells us that at Nice the *digitalis* is commonly given in doses of a scruple in powder, or in that of half an ounce of the infusion made according to the London Pharmacopœia (of 1824) every hour, and without any sensible effect; this fact he explains by stating that the *digitalis*, in the neighbourhood of Nice, is much smaller, and probably less powerful, than the same plant grown in England.

Certain species of *mushroom* are obviously modified in their esculent qualities by climate; Dr. Christison remarks that the

Agaricus Piperatus is eaten in Prussia and Russia, but is poisonous in France. The *Amanita Muscaria* in France and Britain is a violent poison, but in Kamschatka it yields a beverage which is used as a substitute for intoxicating liquors.

The relative proportion of gluten varies in the wheat of different countries; and as in the south of Europe its quantity greatly preponderates over the other principles, we discover the cause that gives such excellence to the maccaroni of Italy. Many species of plants secrete juices in warmer regions, which are unknown in their economy in colder climates; thus the *ash* yields *manna* in Calabria, but loses that faculty as it advances towards the north. The *Myrospermum Frutescens* yields a very different balsam in Grenada from that which it gives in Peru. In estimating the influence of climate upon vegetable productions, we must not overlook the circumstances of moisture, heat, and light; even in our own climate they ought to form important elements in all our investigations. It is probable that we often ascribe to wet and cold, effects which ought to be referred to quantity of light; it is only lately that philosophers have become acquainted with the extensive *chemical* influence of this wonderful agent. How beautifully is this displayed in the leaves of the *Cotyledon Calycinum*, the *Cacalia Ficoides*, and others; for they are sour like sorrel in the morning, tasteless at noon, and bitter in the evening. The formation of acids is effected during the night, by a true process of oxidation; these are deprived of their acid properties during the light of the day, and are changed, by a separation of a part of their oxygen, into compounds containing oxygen and hydrogen, either in the same proportions as in water, or even with an excess of hydrogen, which is the composition of all tasteless and bitter substances.* In wet and cold seasons, our herbage is far less nutritive to cattle, and we accordingly find that they are constantly grazing, in order to compensate by quantity for what is deficient in quality, whereas in dry seasons, a larger proportion of their time is consumed in rumina-

* Liebig's Organic Chemistry.

tion. The same causes, however, that diminish the nutritive powers of plants, frequently increase the energy of those principles upon which their medicinal value depends. It is obvious that many herbs are more rank and bitter in wet and gloomy seasons: this would appear to be a wise and provident law, in order to apportion the natural condiment of the vegetable to the deteriorated state of its nutritive elements, when the digestive organs must require more than the ordinary stimulus for the due exercise of their functions. It is hardly necessary to observe that plants, which in temperate climates are merely shrubs, have been developed into trees, by the hot and humid plains of Africa and Asia; while in the arid deserts of Nubia, or in the frigid plains of Siberia, vegetable life is confined to stunted shrubs and humble mosses: cold also suppresses the colour of flowers, and indeed even that of the leaves, as is witnessed in the *Cyclamen*, *Amaranthus*, and *Ranunculus* of Lapland and Siberia. But climate not only modifies the powers of a remedy by influencing its structure and composition, but it renders it more or less active, by increasing or diminishing the susceptibility of the body to its impression. Can a more striking proof of this fact be adduced than the well-known effects of perfumes at Rome? The inhabitants are unable to sustain the strong scent of flowers in that climate, without experiencing a sensation highly oppressive, and which in some cases is even succeeded by syncope,* and thus realizing the well-known line of the poet, "Die of a rose, in aromatic pain."

As I have been favoured with some very interesting observations upon this subject by Dr. Richard Harrison, who resided for a considerable time in Italy, and was thus enabled to institute a satisfactory inquiry into this curious subject, I feel no

* Women, during the period of gestation, frequently experience such an increased irritability as to be affected, even in England, by various odours, which at other times would produce no extraordinary impression. See "Letters from the North of Italy;" by W. S. Rose, Esq., in which he describes the Venetian ladies as fainting at the odour of common essences. I have already adverted to the influence of aroma when present in wines.

hesitation in introducing a quotation from his letter to my readers.—" You ask me what experience I have had on the subject of climate, as affecting the powers and operation of remedies; I have no difficulty in asserting that narcotics act with greater force even in smaller doses at Naples, where I had the advantages of much experience, than in England. I might adduce as an example the *Extract of Hyoscyamus*, which, when given to the extent of three grains thrice a day, produced in two patients a temporary amaurosis, which disappeared and again recurred on the alternate suspension and administration of this medicine; and it deserves particular notice that these very patients had been in the habit of taking similar doses of the same remedy in England, without any unpleasant result. Now that this depended upon an increased susceptibility of the patient, in the warmer climate, rather than an increased power in the remedy, is unquestionable, since the extract which was administered in Italy had been procured from London; indeed a high state of nervous irritation is the prevalent disorder of Naples. I treated several cases of epilepsy in Italy with the *nitrate of silver*, and with complete success, while in England I certainly have not met with the same successful results. During my residence at Naples, I spent some time in the island of Ischia, so celebrated all over the continent for its baths; many of the patients who were then trying their efficacy, had been attacked by paralysis, apoplexy, and almost every degree of loss of mental and muscular power, and among them I certainly witnessed what with propriety might be denominated a genuine case of *Nervous Apoplexy*. These complaints I was generally able to trace to the abuse of *mercury*, whence we may, I think, very fairly conclude that this metal is more active in its effects than in our own country. Before I quit this subject, I ought to mention that the doses of medicines, as seen in the prescriptions and works of English physicians, excite universal astonishment among the faculty of Italy. In fact, as I have just stated, the human constitution in this part of the continent is certainly more susceptible of nervous

impression than in England: it is perfectly true that flowers or perfumes in a chamber will frequently produce syncope in persons apparently strong and healthy, and the fact is so universally admitted, that the Italians avoid them with the greatest caution." On the other hand, it appears equally evident that some remedies succeed in cold climates, which produce little or no benefit in warmer latitudes. Soon after the publication of the first edition of my Pharmacologia, I received a letter from Dr. Halliday, of Moscow, upon the subject of the "*Eau Medicinale*," and as it offers a striking proof of the efficacy of the *Rhododendron Chrysanthum* in curing the rheumatism of the North, whilst in this country the plant has been repeatedly tried without any signal proof of success, I shall here subjoin an extract from the letter of my correspondent: "In reading your account of the '*Eau Medicinale*,' I perceive that, upon the authority of Mr. James Moore, you state it to be a preparation of the *White Hellebore;* may I be allowed to suggest the probability of its being made from the leaves of the *Rhododendron Chrysanthum?* for, so far as I can learn, the effects of the French medicine are precisely those which are experienced from an infusion of the above plant, which the Siberians and Russians regard as an infallible specific in the cure of chronic rheumatism and gout, and from which I myself, as well as other physicians in Russia, have witnessed the most desirable and decided effects, whenever we have it in our power to administer the remedy with confidence and courage. We have seldom given it in any other form or dose than that adopted by the Siberians themselves, which is to infuse in a warm place, generally near a furnace, and during the night, two drachms of the fresh leaves in about twelve ounces of boiling water, taking care that the liquid never boils. This dose is to be taken in the morning upon an empty stomach, and during its nauseating operation, which generally commences within a quarter of an hour after it has been swallowed, neither solids nor liquids of any description are allowed; after an interval of three or four hours, I have seen the patient obtain a copious

and black fœtid stool, and get up free from pain. Should it happen that the patient does not recover from the first dose, another is administered on the succeeding day, and I have known it to be taken for three days in succession, when the severest fits of gout have been removed.* Is it not then probable that some cunning Frenchman has availed himself of this Siberian specific, and concentrated it in such a form, as to defy all the learned to find it out?"

Dr. Halliday adds, "The Siberians denominate the leaves of this plant, when infused in water, *Intoxicating Tea;* and a weaker infusion is in daily use, especially for treating their neighbours, just as the Europeans do with tea from China." In Hispaniola, *Guaiacum* appears to have been more efficacious in curing syphilis than in this country.

Before we quit the consideration of climate, as being capable of influencing the activity of a remedy, the important fact should not be overlooked, that in India, and other colonies of similar temperature, mercurial medicines, in order to produce their beneficial effects, require to be administered to an extent which would prove destructive to the inhabitants of this island.

But of all the circumstances that produce the greatest change in the aspect as well as in the virtues of the vegetable creation, is CULTIVATION, which may either destroy the medicinal properties of a plant, or raise in it new and most valuable qualities: cultivation converts single into double flowers, by developing the stamens into petals, a change which in many cases destroys their efficacy, as in the camomile, *Anthemis Nobilis;* for, since all the virtues of this flower reside in the disc florets, it is of course greatly deteriorated by being converted into the double-flowered variety. Wormwood, again, by cultivation loses much of its bitterness. By the operation of *grafting*, extraordinary changes may also be produced: Olivier, in his Travels, informs us that a soft *Mastiche*, having all the

* This plant was first described by Gmelin in his *Flora Siberica,* iv. 121. It formerly obtained a place in the Edinburgh Pharmacopœia. Besides the effects stated by Dr. Halliday, it is said by different authors to excite a peculiar creeping sensation in the pained part.

qualities of that resin, except its consistence, which is that of turpentine, is procured by engrafting the Lentisk on the Chian turpentine tree.

Buffon states that our wheat is a factitious production, raised to its present condition by the art of agriculture. M. Virey* observes, that by suppressing the growth of one part of a plant we may respectively give rise to an increased developement in others; thus are some vegetables rendered eunuchs, or are deprived of seeds by obliteration, and only propagate themselves by slips. Such a condition is frequently produced by culture, continued through a long succession of generations; this is the case with the *Banana*, *Sugar Cane*, and other fruits that have carefully been made to deviate for a long series of years from their original types, and having been continually transplanted by slips, suckers, or roots, at length only propagate themselves in this way, whereby the roots, as those of the common potato, become inordinately developed, drawing to themselves the succulence and nutrition originally possessed by the berries. It seems probable that we may thus have lost many vegetable species; the *Tuberes* of Pliny, for example, are supposed by Mr. Andrew Knight to have been intermediate productions, formed during the advancement of the almond to the peach, or in other words that they were swollen almonds or imperfect peaches. If this conjecture be admitted, it will explain the fact stated by Columella, that the peach possessed deleterious qualities when it was first introduced from Persia into the Roman empire. The sweet and bitter almond are but varieties of the same fruit, and there is reason to believe that they are mutually converted into each other, the sweet becoming bitter by neglect, the bitter sweet by cultivation, and the seed of either producing both. If there be any who feel sceptical upon the subject of metamorphoses, let him visit the fairy bowers of horticulture, and he will there perceive that her magic wand has not only converted the tough, coriaceous covering of the almond into the soft and melting flesh of the

* Journal Complementaire du Dict. des Sciences Médicales, tom. ii.

peach, but that by her spells the sour sloe has ripened into the delicious plum, and the austere crab of our woods into the golden pippin; that this again has been made to sport in endless variety, emulating in beauty of form and colour, in exuberance of fertility and in richness of flavour, the rarer productions of warmer regions, and more propitious climates! In our culinary vegetables the same progressive amelioration and advancement may be traced; thus has the acrid and disagreeable *Apium graveolens* been changed into delicious *Celery*, and the common *Colewort*, by culture continued through many ages, appears under the improved and more useful forms of cabbage, savoy, and cauliflower. It has been already observed that the alimentary and medicinal virtues are frequently in opposition to each other, and that while cultivation improves the former, it equally diminishes the latter; I shall have occasion to offer some additional facts upon this curious subject, under the consideration of *Bitter Extractive*, in the history of tonics.

THE UNSEASONABLE COLLECTION OF VEGETABLE REMEDIES.

Vegetable physiology has demonstrated that, during the progress of vegetation, most remarkable changes occur in succession, in the chemical composition, as well as in the sensible qualities of a plant; take as an example the aromatic and spicy qualities of the unexpanded flowers of the *Caryophyllus Aromaticus*, (cloves,) the flower-bud of which, if it be fully developed, loses these properties altogether, and the fruit of the tree is not in the least degree aromatic; so the berries of pimento, when they come to maturity, lose their aromatic warmth, and acquire a flavour very analogous to that of juniper. The *Colchicum Autumnale* may be adduced as another

example, in which the medicinal properties of the vegetable are entirely changed during the natural progress of its developement. To secure the virtues of *Valerian*, its roots should be dug up in autumn, when the leaves begin to decay; the root of the *Taraxacum* should be taken up in April; at any other season its virtues are questionable. The root of hyoscyamus, which some persons have considered as the most active part of the plant, is all but inert in the spring; the juice of three pounds of the root collected near the end of April, when the plant had hardly begun to shoot, killed a dog in somewhat less than two days, while a decoction of an ounce and a half from the root collected on the last day of June, proved fatal in two hours and a half. Experience has also shown that, in the bark of the oak, the quantity of tannic acid varies considerably according to the season; thus, that cut in spring contains, according to Beguin,* four times more of the astringent principle than that which is obtained in winter. The medicinal powers of *Inspissated juices* are greatly controlled both by soil and season. Dr. Fothergill says, "I know from repeated experiments that the extract which has been prepared from *hemlock*, before the plant arrives at maturity, is much inferior to that which is made when the plant has acquired its full vigour, and is rather on the verge of decline; just when the flowers fade, the rudiments of the seeds become observable, and the habit of the plant inclines to yellow, *is the proper time* to collect it." The lettuce, when young, scarcely possesses any narcotic property, and in the poppy, the narcotic principle is not apparent until the petals fall and the germen enlarges.

The leaves of *Digitalis* should be gathered just before, or during the period of inflorescence; and those of *Hyoscyamus*, when the plant is in full flower, and not until the second year of its duration. Great attention should be paid to such rules; and wild and native plants should always be preferred to cultivated specimens.

* Philosophical Transactions, 1799.

THE IGNORANT PREPARATION, FRAUDULENT ADULTERATION, AND SPONTANEOUS DETERIORATION OF MEDICINES.

The circumstances comprehended under this head certainly deserve to be ranked amongst the more powerful causes which have operated in affecting the reputation of many medicinal substances. The Peruvian bark fell into total discredit in the year 1799, from its inability to cure the ague; and it was afterwards discovered to have been adulterated with bark of an inferior species; indeed Sydenham speaks of its sophistication before the year 1678, and tells us that he had never used to exceed two drachms in the cure of any intermittent, but that, of late, the drug had become so inert, rotten, and adulterated, it became necessary to increase its dose to one, two, or even three ounces. Very few practitioners have an idea of the fatal extent to which this nefarious practice is carried on, or of the systematic manner in which it is conducted. There can be no doubt but that the sophistication of medicines has been practised in degree in all ages;* but the refinements of chemistry have enabled the manufacturers of the present day not only to execute such frauds with greater address, but unfortunately at the same time to vend them to the public with less chance of detection. It will be scarcely credited when I state that many hundred persons are supported in this metropolis by the art of adulterating drugs, besides a number of women and children who find ample employment and excellent profit in *counterfeiting* cochineal with coloured dough; peppercorns with peas-meal; isinglass with pieces of bladder

* Dr. Murett, in his "Short View of Frauds and Abuses," (A.D. 1669,) charges the apothecary with "falsifying medicines;" "They showed the censors," says he, "*myrtle leaves* for *senna;* a *binder* for a purger; *mushrooms* rubbed over with chalk for *agaric; hemlock* for *pœony; sheep's lungs* for *fox's lungs;* and the bone of an *ox's heart* for that of a *stag's heart.*

and the dried skin of soles; and in filling up with powdered sassafras the holes which are bored in spice and nutmegs, for the purpose of plundering their essential oils. In fact, an account of the various methods employed for adulterating the articles of the Pharmacopœia would occupy a volume. The colleges of London and Edinburgh, fully sensible of this increasing evil, have added short notes, by which the purity of the leading medicines may be ascertained. Nor is ignorance less to be feared than fraud; every person of the least experience must know that the credit of a remedy continually suffers from the ignorance of those who prepare it.

With regard to the deterioration which many articles undergo by having been too long kept, I would observe that, although no honest practitioner would retain in his service such organic products as have undergone an obvious change, still he may not be aware of the nature and extent of those alterations which spontaneously take place in the composition, and consequently in the virtues, of many vegetable preparations; the influence of air, and above all *light*, in producing changes upon green vegetable powders, is not generally understood; in daylight the green matter absorbs carbonic acid, and emits oxygen; while in the dark a chemical action of a different nature takes place, the leaves and green parts containing volatile oils, or volatile constituents, absorb oxygen, and are thus converted into resin; and these changes are wholly independent of vitality. I shall show hereafter that certain saline additions to vegetable matters will occasion decompositions, of which the latter in their unmixed forms are not readily susceptible; at the same time it will appear that vegetable matters will frequently occasion essential changes in the composition of the salts with which they may be associated. The subject offers to the pharmaceutist many important points for further investigation; and to those desirous of pursuing it, I strongly recommend the work of Professor Liebig "On Organic Chemistry," and I would more particularly direct attention to that class of phenomena, to which he

has given the name of "*Eremacausis*," or slow combustion. His researches and reasonings claim an importance not to be surpassed by that of any chemical inquiry of the present day.

THE OBSCURITY WHICH HAS ATTENDED THE OPERATION OF COMPOUND MEDICINES.

It is evident that the fallacies to which our observations and experience are liable with respect to the efficacy of certain bodies, as remedies, must be necessarily multiplied when such bodies are exhibited in a state of complicated combination, since it must be always difficult, and sometimes impossible, to ascertain to which ingredient the effects produced ought to be attributed.

How many frivolous substances have from this cause alone gained a share of credit, which belonged exclusively to the medicines with which they happened to be accidentally administered.* Numerous are the examples which I might adduce in proof of this assertion; the history of Bezoar†

* The editors of the *American Medical Recorder*, (vol. i. p. 471,) in descanting upon the efficacy of Prussic acid, very gravely remark, that they are acquainted with a lady subject to hysteric affections, who *always* derives relief from a dose of CHERRY BRANDY, in which *peach kernels* have been digested. The stimulus of the brandy then goes for nothing! Nothing can exceed the absurdity of this case; unless, perhaps, that of the philosopher who deduced an unfavourable opinion of the qualities of *green* tea, from finding that the hair of a pig's tail was separated by immersion in its infusion, forgetting to repeat the experiment upon simple warm water at the same temperature. Zimmermann, not unaptly, compares a man who is intoxicated with a favourite opinion to a passionate lover, who sees and hears nothing but his mistress.

† BEZOAR, (from *Pa-hazar*, Persian, a destroyer of poison.) A morbid concretion formed in the bodies of land animals. Several of them were formerly highly celebrated for their medicinal virtues; they were consi-

would in itself furnish a mass of striking evidence; indeed the reputation of this absurd substance was maintained much longer than it otherwise would have been, by its exhibition having been frequently accompanied with that of more active articles. Monardes, for instance, extols the efficacy of the *Bezoar* as a vermifuge, but he states that it should be mixed with the seeds of *Wormwood.* Besides, in the exuberance of mixture, certain reactions and important changes are mutually produced, by which the identity of the original ingredients is destroyed; but this subject will be introduced for discussion in the third part of the Pharmacologia.

considered as powerful *alexipharmics,* so much so that other medicines, possessed of alexipharmic powers, were called *Bezoardics:* so efficacious were these substances formerly considered, that they were bought for ten times their weight of gold. Avenzoar, an Arabian physician, who practised at Seville, in Spain, about the year 1000, first recommended it in medicine. A composition of Bezoar with absorbent powers has been extensively used under the name of *Gascoigne* powder, and *Gascoigne's Ball;* but the real Bezoar was rarely used on this occasion; gypsum, or pipe-clay tinged with ox-gall, proved a less expensive ingredient.

PHARMACOLOGIA.

PART II.

ON THE

PHYSIOLOGICAL AND CHEMICAL ACTION OF MEDICINAL SUBSTANCES,

WITH A

SPECIAL REFERENCE TO THEIR SCIENTIFIC ADMINISTRATION.

"Medicos tandem tædet et pudet, diutius garrire de Remediis, Specificis, et Alexipharmicis, et cæteris, nisi eorum naturam et modum quo prosint, quodammodo ostendere et explanare possint."—*Conspect. Med. Theor.*

PHARMACOLOGIA.

PART II.

ON THE OPERATIONS OF MEDICINAL SUBSTANCES, AND ON THE CLASSIFICATIONS FOUNDED ON THEM.

1. Medicinal substances are those bodies which by due administration are capable of producing changes in the condition of the living system, whereby its morbid actions may be removed or controlled.

2. In adopting this definition, we intentionally exclude those alimentary substances which are more immediately subservient to the support of life, and to the repair of that diurnal expenditure and waste which the exercise of its functions so invariably occasions. Their history constitutes a distinct branch of science, to which I have dedicated an independent work.*

3. It has been very generally supposed that substances, whose application does not produce any sensible action upon the healthy system, cannot possess medicinal energy; and, on the contrary, that those which occasion an obvious effect must necessarily prove active in the cure or palliation of disease. To this general proposition, under certain limitations and restrictions, we may perhaps venture to yield our assent; but it cannot be too early, nor too forcibly impressed upon the mind of the young practitioner, that *medicines are, for the most*

* A Treatise on Diet, &c.

part, but relative agents, producing their effects in reference only to the state of the living frame. We must, therefore, concur with Sir Gilbert Blane in stating that the virtues of medicines cannot be fairly essayed, nor beneficially ascertained, by trying their effects on sound subjects, because that particular morbid condition does not exist which they may be exclusively calculated to remove;* thus, in a robust state of the body, the effects of *steel*, in commendation of which, in certain diseases, professional opinion is unanimous, may be wholly imperceptible. Bitter tonics, also, may either prove entirely inert, or they may give strength, relax the bowels, or induce constipation, according to the particular condition of the patient to whom they are administered; so again in a healthy state of the stomach, a few grains of soda or magnesia will not occasion the least sensible effect, but where that organ is infested with a morbid acid, immediate relief will follow the ingestion of the one, and purgation that of the other. By not reasoning upon such facts, physicians have, in my opinion, very unphilosophically advanced to conclusions respecting the inefficacy of certain agents. They have administered particular preparations in large doses, and not having observed any visible effects, have at once denounced them as inert. I might allude, for instance, to the *tris-nitrate of bismuth*, a substance which, however powerless in health, I am well satisfied, from ample experience, is highly efficacious in controlling certain morbid states of the stomach. Dr. Robertson† has well observed, that disease calls forth the powers, and modifies the influence of medicines. That which agitates the calm of health may soothe the irritation of illness, and that which without opposition is inert, may act powerfully where it meets with an opponent. Experiments should be made on the sick, in order to determine how the sick will be affected, and nothing should be pronounced feeble, merely because it has done nothing where there was nothing to be done.

* Medical Logic. Edit. 2, page 92.

† Edinburgh Med. Journal. April, 1832.

4. The Modus Operandi of remedies, or the general principle upon which they effect salutary changes in distempered states of the body, is so involved in obscurity that we cannot be surprised it should have given rise to much ingenious speculation, and animated controversy. It would seem, however, that the immediate impression of a medicinal substance may depend upon mechanical, chemical, or vital agency; and that the sanative impulse thus occasioned may either be absolute or relative, primary or secondary, local or general, direct or sympathetic, permanent or transient; for example, certain purgatives will occasion intestinal excretion in almost every condition of the body, and may so far be considered as *absolute* agents; whereas *diuretics*, since they generally require for their successful action a certain state of the living system, may with equal truth be regarded as *relative* in their operation; in like manner it will be shown, that a medicine may coerce a particular organ *directly*, or affect its functions through a general influence upon the body; but in order that we may more fully and satisfactorily examine all the bearings of this difficult, and yet most highly-important subject, we may conventionally admit the following classification; and I will take the opportunity of observing, with respect to this, or any other similar arrangement, that it is merely intended as an artificial scheme to stimulate the examination of facts, and must be modified as our knowledge becomes more perfect.

THE PARTICULAR

ORGANS, FLUIDS, AND TISSUES OF THE BODY,

MAY BE ACTED UPON THROUGH

FOUR DISTINCT CHANNELS, OR MODES OF COMMUNICATION.

I. By the actual contact of the appropriate remedy.

A. Conveyed through the medium of the circulation to distant parts, *without decomposition.*

Internally.

a. Through the lacteal vessels.
b. Through the branches of the venæ portarum.
c. Through the capillaries.
d. Through the absorbents of the alimentary canal.
e. Through the absorbents of the bronchial vessels.

Externally.

f. Through the divided blood-vessels.
g. Through the lymphatics.

B. Conveyed by absorption, *with decomposition;* by which one or more of its constituents are developed, and carried into the circulation.

a. Through the same channels as in the preceding case.

II. By an impulse conveyed through the instrumentality of nerves.

a. Through the sympathy of their peripheral extremities.

b. Through the intervention of the nervous centres, and their reflex action.

III. By the sympathetic control exerted by the stomach and alimentary canal on distant parts.

IV. By the operation of contiguous sympathy, or by that which is excited by the mere proximity of parts.

Upon each of these several divisions of the subject I shall proceed to offer some remarks and illustrations.

I. A. *On Remedial Agents conveyed into the System by Absorption*, without decomposition.

5. That certain bodies are capable of evading the assimilating functions, and of entering unchanged into the circulating current, is a fact which is capable of physiological, chemical, and therapeutical demonstration; thus, the physiologist has proved that a substance introduced into a closed cavity may disappear,—the chemist has traced it into the blood, and detected its presence in the secretions, or tissues of the body, while the physician has recognised its specific effects upon the organs with which it has come into contact, or through which it has passed. Demonstration can go no farther.

6. The *carbonate, chlorate, nitrate, and sulpho-cyanite of potass*, and the *bi-borate of soda*, pass unchanged through the blood, and are excreted by the kidneys. *Ferro-cyaruret of potass (prussiate of potass)* has been detected in the urine by Westrumb, from two to ten minutes after it had been swallowed, as well as by several other physiologists after different intervals. I have myself made many experiments upon this subject, and have verified to my entire satisfaction several of

those of Christison, Coindet, Tiedemann, and others. Mr. Brande has also shown that the urine may become alkalescent after taking alkalies, whether they be in their caustic or carbonated state,* a fact which I have frequently witnessed in practice, as well as that of alkaline urine becoming acid, under the use of nitric acid. Some essential oils, camphor, particular bitter principles, and certain colouring matter, seem also capable of passing the barriers of digestion, and of circulating to remote parts. The fact that nurses, under the influence of particular medicines, are capable of communicating their effects to the child, through the medium of their milk, admits, as far as I know, of no other explanation. A purgative given to the nurse will often act violently upon the child, without in the least affecting the individual herself. In like manner will alkalies, taken by the nurse, relieve acidities in the infant; and mercury given through a similar medium will cure syphylitic symptoms in the infant at the breast. Dr. Locock mentions† a very curious case, on the authority of Mr. Keate, of a foreign gentleman, who was his patient, being in the habit of regulating his hepatic system, whenever his motions indicated deficient bile, by taking asses' milk medicated by giving the animal a certain quantity of the *nitrate of mercury;* the effect was very marked, and he was unable to endure mercury in any other shape. M. Barbier relates a case in which an infant was affected by the milk of his mother, who had taken a large dose of the *wine of opium.* Nor will it be denied that the milk of cows becomes impregnated with the odour and taste of the vegetables upon which they are fed. Dr. Stevens states that there is a small indigenous plant which grows in Tennesee, on the banks of the River Cumberland, and in other parts of the western district of the United States, called by the natives the "*Indian Hachy;*" it has blossoms of a bluish colour, and is so very poisonous that the milk of the

* Phil. Transact. 1810.

† Encycloped. of Medicine. Art. *Lactation.*

‡ Stevens on the Blood, p. 248.

cows that have fed upon this plant is sometimes so saturated with the poison, that the small quantity used with tea produces fever, with the most violent symptoms, and in some cases even death. Dr. Greville, on the authority of Langsdorf, informs us that a fungus, denominated *Amanita Muscaria*, is so powerfully narcotic, as not only to inebriate those who take it, but to impart its properties to the urine, and it is said that the inhabitants of the north-eastern parts of Asia actually use it for this property, and some extraordinary stories are related of its effects.

7. Equally evident is it that the oily principle, upon which depends the odour of certain fish, is absorbed from the alimentary canal, and carried into the blood; hence the peculiar rank flavour of the flesh of certain birds that live upon fish. It is also well known that persons who are confined for any length of time to a diet of rank fish, secrete a sweat of a characteristic smell, and which, if not carried off, may become the source of cutaneous disease.

8. In morbid states of the digestive organs, unassimilated matters may be taken up, and excreted by the kidneys. In typhoid fevers, where the excrementitious matters have not been removed, it has been frequently observed that an offensive odour from the lungs and skin is discernible.

9. Colouring matters are also occasionally absorbed. The *Indian fig*, when eaten, renders the urine of a bloody colour; *rhubarb* also imparts its characteristic hue; but one of the most extraordinary instances of this kind is that discovered by Dr. Professor Rapp, of Tubingen,—a poisonous substance long known under the name of *Indigo bitter*, and shown by Liebig to be a peculiar acid, to which the name of *carbozotic acid** has been given, is of so intense a yellow colour, that it will impart a perceptible tint to a million parts of water. After

* The crystals consist of carbon, nitrogen, and oxygen, (C^{15} Az^3 O^{15}.) It is produced by the action of nitric acid on indigo, silk, and other azotised substances. Braconnot also formed it by the action of the same acid on aloes.

death, from this poison, the various textures and fluids throughout the body have been found dyed. In like manner will *madder* colour the bones, and *nitrate of silver* the skin.

10. The fact of the absorption of medicinal substances into the circulation having been thus proved, we have next to show through what channels they are so conveyed, and I think it may be rendered evident that the lacteals, veins, and lymphatics, are severally engaged in the service.

11. The lacteals, it would appear, from the experiments of Tiedemann, Gmelin, Muller, and others, are capable of taking up saline bodies, while they reject both odorous and colouring matter; but these latter having been detected in the blood, must have passed through some other channel; the colouring matter of rhubarb, for example, could not be recognized by the above-named physiologists in the chyle, but it was found in the serum of the blood of the mesenteric, splenic, and portal veins; in like manner they failed to distinguish the odour of camphor in the chyle, but they detected it in the blood of the *vena portarum*, and in that of the mesenteric vein of a horse, to whom they had given that substance.

12. Numerous experiments have been instituted by Majendie, De Lille, and Segalas, the results of which appear to establish the fact of venous absorption. That the *vena portarum* constitutes one of the avenues through which certain bodies are at once carried into the system, there cannot be a doubt. Dr. Wilmer, of Munich, gave a dog from four to twenty grains daily of the *acetate of copper* for several weeks, and after death he found the metal in the substance of the liver, but in no other part.

13. The passage to the lungs, the mucous membranes of which are plentifully supplied with absorbents and capillaries, affords another entrance to bodies into the circulation, although in this case it is evident that the medicinal body must be in a state of vapour, or held dissolved in the inspired air. Dr. Rousseau, of Philadelphia, has shown by experiment that certain volatile substances,—as *turpentine*, *camphor*, *garlic*, &c.,

are very rapidly taken up during respiration, and transmitted to the current of the blood. It is a well-ascertained fact that intoxication may be rapidly produced by the inhalation of spirituous vapour,* since persons engaged in pumping ardent spirits in the cellars of the distiller become affected, without having taken the smallest quantity into the stomach. It is also well known that healthy persons have been affected by mercury, by sitting for a few hours near those who were under its influence. In a practical point of view this subject is highly important, and I shall have occasion to recur to it when I come to treat of the subject of *Inhalation.*

14. The subject of the absorption of substances from the surface of the body, embraces three distinct propositions. 1. *With regard to the absorbing powers of the skin from simple contact.* 2. *From friction.* 3. *From the removal of the cuticle.*

15. The ancients as generally believed in the absorbing powers of the skin as modern physiologists have doubted it. It is certainly true that the cuticle offers a very considerable impediment; but, nevertheless, there are remedies which, under certain circumstances, would appear to pass the barrier, and enter the circulating vessels. Dr. Madden composed an essay, entitled "*An Experimental Inquiry into the Physiology of Cutaneous Absorption, and its Applications to Therapeutics,*" which was honoured by the gold medal from the medical faculty of Edinburgh, in 1837. His object was to defend the ancient opinion. After the immersion of his arm in a solution of *hydriodate of potass* for an hour, *iodine* was detected in the urine; he also found that a solution of *jalap*, *rhubarb*, or *gamboge*, when applied to the abdomen, was invariably followed by purgative effects.

* Dr. Rousseau, however, maintains that the spirituous vapour, unlike the others, acts through the medium of the nerves, without being absorbed, and asserts, that by closing the nostrils it may be inhaled for an hour without any effect. Whether this be the fact or not, with respect to spirit, it is certainly the case with several other vapours.

According to Etmuller, the *veratrum album* will produce vomiting under similar circumstances.

16. When, however, the application to the skin is assisted by friction, the results are less equivocal. It was recommended by the ancient physicians, but fell into disuse from the uncertainty of its effects, until restored by Brera, Christison, and others; and in the early part of the present century, mercury was rarely introduced by any other process than that of inunction.

17. The most effectual mode, however, of introducing medicines into the system, through the external surface, is by removing the cuticle, for the practical knowledge of which we are indebted to MM. Lambert and Lesieur.* A blistering-plaster, or a vesicating ointment, having been previously applied, the remedy to be absorbed is placed upon the denuded surface. It is termed the *Endermic* method, for an account of which the reader may consult *The Edinburgh Medical and Surgical Journal*, vol. xxxi.

18. A most interesting question has arisen in modern times as to the mechanism of absorption. It is now very generally believed that there are no vessels terminating by open extremities, as Haller and others imagined; and even Bichat's idea of exhalent vessels being the open side-branches of the capillaries has been disproved. The opinion now prevails that all animal textures are permeable to fluids, by virtue of their pores, and that absorption is effected by what Majendie calls *Imbibition;* the phenomena of which, under the terms of *Exosmose* and *Endosmose*, have been fully investigated by M. Dutrochet.†

19. There can be no difficulty in explaining the operation of remedies externally applied to wounds or abraded surfaces; they must pass into the circulation through the lymphatics, capillaries, or divided veins.

* *Essai sur la Méthode Endermique*, par A. Lambert, 1828.

† See Muller's Physiology, translated by Baly, vol. i. p. 242, &c.

20. The medicinal substance then having, through one or more of the channels above stated, found its way into the general current of the circulation, we have next to inquire what becomes of it. Here then arises another question of singular interest, and of great practical importance, as being one which will not only influence our theoretical views, but which must give a scientific direction to our practice. It is evident that the substance thus introduced must either be subsequently ejected from the body, through the medium of some of its secretions or excretions—or become united to some of its textures—or combined with, or wholly decomposed by, the vital action of the blood or its vessels.

21. It would appear that some substances are at once ejected through the alimentary canal, in union with certain matters with which *in transitu* they may have come in contact. Others are discharged through the kidneys, as certain *saline bodies;* others again, from the bronchial surfaces, as *camphor;* and some from the skin, as *sulphur.*

22. It has been stated, that the organ, in giving exit to the medicinal substance, receives from it a stimulus during its transit; it is thus, for instance, that the operation of certain diuretics is to be explained. To this law, however, there are many exceptions, for it would appear that to some bodies the vessels give a passive reception, and eject without giving any indication of their action.*

23. That certain remedies should act upon particular organs, and leave others wholly uninfluenced, is a fact which appears to me to be far less mysterious than some physiologists have supposed. The substance in question necessarily pervades the whole organization, through the medium of the circulating blood,† but it will only affect such organs as possess a peculiar

* The colouring matter of rhubarb, and the odorous principle of asparagus, are to be recognised in the urine of those who have taken these substances, while their diuretic influence cannot be discovered.

† Tartar emetic injected into a vein, and therefore circulating through every tissue, only produces vomiting.

susceptibility of its action; but this is only one of the manifestations of a general law of the living body; sulphuretted hydrogen is daily in contact with the surface of the alimentary canal with impunity, but bring only a cubic inch of it into contact with the bronchial membrane, and immediate death ensues; is it extraordinary, then, that *potassio-tartrate of antimony* should act powerfully upon *mucous*, while it displays little or no influence upon *serous* membranes; that *infusion of tobacco*, according to Brodie, should act upon the heart; that *narcotics* should influence the brain; *strychnia*, the spinal cord; *mercury*, the liver and salivary glands; *cantharides*, the urinary organs; *iodine*, the glands, &c.? For the same reason that plants, whose seeds are scattered over the whole surface of the earth, by winds or birds, will vegetate only on those spots in which they find the conditions essential to their life;* or that *iodine*, which pervades the waters of the ocean, is to be found only in a few of the fuci.

* Liebig observes, that "it is thought very remarkable, that those plants of the grass tribe, the seeds of which furnish food for man, follow him like the domestic animals. But saline plants seek the sea-shore, or saline springs; and the *chenopodium*, the dunghill, from similar causes. Saline plants require common salt, and the plants which grow only on dunghills need ammonia and nitrates, and they are attracted whither these can be found, just as the dung-fly is to animal excrements. So likewise none of our corn-plants can bear perfect seeds, that is, *seeds yielding flour*, without a large supply of phosphate of magnesia and ammonia, substances which they require for their maturity. And hence these plants grow only in a soil where these three constituents are combined, and no soil is richer in them, than those where men and animals dwell together; where the urine and excrement of these are found, corn-plants appear, because their seeds cannot attain maturity unless supplied with the constituents of those matters. When we find sea-plants near our salt-works, several hundred miles distant from the sea, we know that their seeds have been carried there by wind or birds, which have spread them over the whole surface of the earth, *although they grow only in those places in which they find the conditions essential to their life.*"

I. B. On remedial agents conveyed into the system by absorption, with decomposition, by which one or more of the Constituents are developed.

24. The greater number of substances that act by being absorbed will be included in this category; for there are comparatively few that do not undergo some change during their transit and final exit from the body. Dr. Cullen long since stated, that "with respect to vegetables, and also some animal substances, it is often a certain portion of them only that can be subjected to our digestive organs, while the medicinal part of the same is hardly affected, and therefore it may be alleged that their operation on the interior parts is not prevented by the powers of digestion;" but I believe that previous to the publication of the third edition of my Pharmacologia, no author had attempted to give to this vague proposition a more definite form, or to examine the laws by which such decompositions may be governed. Since that period, however, writers on Materia Medica have accepted the theory, and it now very generally enters into all speculations regarding the operation of medicinal bodies; but before we proceed to such an inquiry, it will be necessary that I should explain certain views with regard to the probable nature of that chemical action which takes place in the body, under the influence of the vital powers. In a future part of the work I shall discuss the subject more fully, confining my remarks upon the present occasion to such points as are more immediately involved in the question before us.

25. Organic and inorganic bodies consist of elements which are common to both, but they differ essentially in the manner in which they are combined; as far as we can discover, *Inorganic* bodies consist of *Binary* compounds, that is, of two elements in union, as *Oxygen* and *Hydrogen; Carbon* and *Oxygen;* and so on; now, one such binary compound may unite with a second, and thus become farther complicated, or it may unite

with one single element; but still, however complex the inorganic body may be, its elements will be grouped in the way I have stated, and when decomposed will again re-combine in accordance with the same law.* Not so with organic compounds, since the elements of which they consist, never less than three, are so combined that each is equally united with all the others, forming peculiar *proximate* principles which are termed *ternary* or *quaternary*, according to the number of elements of which they are composed. It is evident, therefore, that the same elements united in the same numerical proportion of their atoms may, from the mere fact of their being differently grouped or combined together, give rise to compounds essentially different. To compounds that contain the same elements in the same proportions, and yet, from the different collocation of their several atoms, are essentially distinct from each other in properties, Berzelius has given the name of *Isomeric* from ισος, equal, and μερος, part, expressive of equality in the ingredients.†

* The following interesting experiment will afford an instance of a play of affinities which may probably assist in rendering the above views more intelligible. Tin, as far as we know, is an elementary body. Nitric acid is a *binary* compound of nitrogen and oxygen—water, of oxygen and hydrogen. Let these substances be brought together,—the binary compounds will be decomposed, and two fresh binary compounds produced —thus. The oxygen of the water and that of the acid will unite with the metal and form oxide of tin, while the hydrogen of the former combining with the nitrogen of the latter will form ammonia; but as there will exist some undecomposed acid, the two binary compounds will unite, and form nitrate of ammonia. If we now add some lime, (oxide of calcium,) we shall produce another exchange of principles,—nitrate of lime will result, and ammonia be volatilized. We see, in this instance, that the elements of the binary compounds, after decomposition, re-unite, so as to form other compounds which are still binary.

† Malic and citric acids are *Isomeric* bodies, so are the tartaric and racemic acids. The oils of juniper, turpentine, and savin, are each composed of carbon 10+ hydrogen 8—.

The different results arising from the different collocation of the same elements in the same proportion may be rendered more intelligible by an example: thus, one atom of urea and two atoms of water may be thus

The reader will now perceive the precise meaning which is attached to the terms *Binary*, *Ternary*, and *Quaternary*, as used in this work; Dalton and other chemists have differently applied them.* The importance of the distinction will appear as we proceed to investigate the chemico-vital laws, which constitute the basis of the present inquiry.

26. It would appear, then, that *ternary* and *quaternary* compounds, in the sense here assigned to them, are exclusively† the products of organization; for although the chemist may have the power of resolving them into their elements, he cannot re-produce them; and in animal life the powers of nature appear also limited, for although she can raise ternary into quaternary compounds, as frequently happens in the conversion of vegetable into animal matter, she is incapable of raising binary‡ into ternary arrangements; that is the province of the vegetable kingdom; thus plants have the power of generating their proximate principles from carbonic acid, ammonia, and the atmosphere; and were it otherwise, as M. Müller truly

expressed, $\overbrace{C\,O\,N\,H}^{}_{2\;2\;2\;4} + \overbrace{O.H}^{}_{2.2}$. By a change in the arrangement we obtain two atoms of carbonate of ammonia; thus, $\overbrace{C\,O}^{}_{2.4}$ = carb. acid + $\overbrace{N.H}^{}_{2.6}$ = ammonia.

* To express the *number* of atoms, without reference to their collocation, or modes of union.

† Exceptions have been adduced to this general proposition, but upon examination most of them will turn out to be rather apparent than real. Urea may perhaps be allowed as a true exception, although Müller does not acknowledge it.

‡ It may be said that in the various processes in the animal body water is often decomposed, and its elements appropriated; but Dr. Prout observes that there is reason to believe that the decomposition either takes place when in a state of combination with other principles, or during the act of its separation from, or combination with, such principles, and that *water, as water, is rarely decomposed by the animal body;* besides, water can hardly be regarded as a chemical agent in the living body; its use is to impart that form and fluidity essential to its functions. Berzelius is of opinion that it is not chemically combined with the solids, as it can be given off by evaporation, or even by strong pressure.

observes, organic matter would ultimately disappear, since a certain amount is constantly converted into binary compounds by putrefaction, combustion, and disease, as in the mal-assimilation of food, &c. (32,) hence vegetables may be said to be the laboratories in which the inorganic kingdom is rendered subservient to the maintenance of animal existence.

27. Although the animal functions may be incapable of exalting *binary* into higher grades of combination, they possess the power of preserving *ternary* or *quaternary* compounds, in opposition to the chemical affinities, whose tendencies are to resolve them into *binary* arrangements. Putrefaction is nothing more than the effect of chemical ascendency, when vital power has lost its control; but so energetic is the latter, that even after that series of changes, which would lead to a final resolution into binary compounds, has commenced, it appears capable of arresting its progress, and even, as it were, of recalling the rebellious atoms to their allegiance; for, according to the experiments of Spallanzani, and still more recently, those of Dr. Beaumont, if, after putrefaction has actually advanced, a substance in such a condition be introduced into the living stomach, the process is immediately checked, and no signs of putrefaction are presented by the digested food, although, were the same substances left at the temperature of 99° Fah., they would soon evince evidence of its progress. It is, therefore, clear that the vital powers of the digestive organs must, in such cases, reverse or suspend the ordinary chemical affinities.

28. But the living powers go farther; they not only are capable of giving stability to such compounds, in defiance of ordinary affinities, but they can modify them by additions or substitutions, as seen in the formation of the different secretions. By what vital affinities such changes take place are wholly unknown. It may be that the molecular or atomic collocations are changed, or that certain compound organic radicals remaining entire, may appropriate to themselves par-

ticular elements, to be in their turn displaced by others, according to what has been termed the "*Theory of Substitutions*," so beautifully developed by Dumas and Laurent.*

29. We have next to inquire under what circumstances ternary and quaternary compounds may lapse into binary arrangements. In the numerous changes which take place in the animal or vegetable substances introduced into the system as food, we may suppose that, during their transmutation, certain elements will be abandoned, and re-uniting into binary compounds, be rejected from the system as excrementitious; thus are sulphur and phosphorus, existing in the blood, thrown off when in excess, as sulphuric and phosphoric acids. Oxalic acid is occasionally a binary compound formed in the body, since it is found in the urine of those who have never taken it into the stomach. Sulphuretted hydrogen is not unfrequently discharged from the intestines—carbonic acid from the lungs, and skin, &c. So that it would appear many bodies not appropriated as nourishment are excreted, as binary compounds, through some one of the portals of the body; and most of our remedies, inasmuch as they are incapable of becoming organized, fall under this category, and are thrown off as excrementitious; not, however, until, during their transit, they may have produced impressions salutary or otherwise, according to the circumstances and conditions of the body.

30. It is, therefore, evident that, in estimating the powers of the digestive organs in combining or decomposing bodies, we must draw a grand distinction between those capable of being organized, and of entering into the composition of living struc-

* For an account of which the reader may consult Thomson's Organic Chemistry. To give an example: *Benzule* is a lately discovered compound which consists of $C^{14} H^5 O^2$; now, if to this *organic radical* we add an atom of oxygen, it becomes benzoic acid; and if, instead of this atom, we substitute an atom of hydrogen, it becomes oil of bitter almonds. Thus,

$C^{14} H^5 O^2 + O$ = benzoic acid.
$C^{14} H^5 O^2 + H$ = oil of almonds.

tures, and of those which, being unconvertible, must be treated as excrementitious.

31. Before we quit the subject of the composition of organic substances, it will be necessary to make a few observations upon the existence of certain mineral elements and compounds, which apparently form essential ingredients, and perform some important, though hitherto mysterious service, in the constitution of the animal fabric; and, since they are derived from without, they might appear to oppose a serious exception to that general law which we have endeavoured to establish: *viz.* that ternary and quaternary compounds are alone capable of assimilation. These bodies were long regarded as extraneous, or foreign to the composition of animal matter, but they are distributed through the different textures with a regularity which must at once negative such an idea; indeed, each tissue would appear to have its peculiar mineral contents; "Hence," observes Dr. Prout, "as the geologist is often enabled to identify strata by the similarity of the fossils embedded in them, so the physiologist is enabled to identify organized tissues by the similarity of the incidental mineral matters they usually contain; thus, the nervous mass is characterized by the presence of *Phosphorus;* a peculiar tissue intimately connected with the nervous, by the presence of *Magnesia;* certain submucous tissues, by the presence of *Lime*, &c."

32. It has been a question much agitated whether these incidental matters exist in organized bodies as *binary* compounds, or in their elementary state in union with other principles. Berzelius entertains the latter opinion, which is much strengthened by the fact, that the particles of such earthy and saline matters, however small their proportion to the whole mass, are never aggregated together, but are equally diffused through it, which could scarcely happen if they existed as independent bodies under the influence of their mutual affini-

* Researches in agriculture have fully demonstrated the importance of such bodies in the economy and growth of plants; indeed, vegetation cannot proceed without them.—See note, p. 144.

ties. Upon the destruction, however, of the textures in which they exist, they are emancipated in *binary* forms, having combined with the oxygen of the atmosphere, or with that derived from the decomposition of water, or with any other principle furnished by the organic matter. Here, then, we are presented with another important illustration of that law of decomposition already noticed, (26. 29.)

33. From the preceding views, Dr. Prout has deduced the following practical inference, and which supports in a very satisfactory manner the general theory of organic decomposition. "When incidental mineral matters appear as binary compounds among organized products, the mal-assimilation or destruction of organized tissues is not only indicated, but the exact nature of the tissue thus mal-assimilated or destroyed, may be predicated from the nature of the binary mineral compound."

34. After these preliminary observations, we shall be better enabled to comprehend the operation of such remedies as are, after certain decompositions, absorbed into the system. Before any absorption, however, can take place from the interior of the body, it is essential that the substance be in a state of solution, either by virtue of its own nature, or in consequence of its combination with some of the animal fluids; when this is not the case, it is voided through the alimentary canal, and thus at once ejected. This may explain several of the facts detailed in the experiments of Woehler and others, wherein the substances in question were not discovered in the blood or secretions. There is also another circumstance which may render their appearance doubtful; if *ternary* compounds, they may be transformed into alimentary products, or, in other words, be digested;* but let us seek instruction from the

* This is probably the reason of many bodies producing but little effect upon the inferior animals. The vegetable eaters are certainly less affected by vegetable poisons than those animals who exclusively live upon animal substances: it is thus that a rabbit can take a very large dose of opium without any ill effects, while half the same quantity would poison a man.

changes which those substances undergo, *in transitu*, of which some of their elements are to be recognized during their exit from the body.

35. It has been already stated, (6,) that in common with several other bodies, *Nitrate of Potass* is absorbed into the circulation, and excreted with the urine, without undergoing any change in composition; now this salt consists of two *binary* compounds in union with each other, and therefore, according to our views, cannot, by any act of the digestive process, become organized; it is therefore strictly excrementitious, and is eliminated without decomposition. Not so the *Tartrate*, *Acetate*, and *Citrate* of the same alkali, for their acids are ternary compounds, and are consequently subjects for assimilation, while their base, being set free, finds its way out of the system in the state of carbonate.* The *Oxalic acid* and its compounds may, perhaps, appear as exceptions to this general law, but I must remark that the oxalic acid is now admitted to be a *binary* compound of two atoms of carbon and three atoms of oxygen, which at once excludes it from our category, and may explain its singular action upon the system, and the fact that the *oxalate* is the only salt with a vegetable acid that reaches the kidney, and enters into the composition of a urinary calculus.† For the same reason, *Bi-borate of Soda* passes without

It is a curious fact, that a sound horse can take a very considerable portion of opium with impunity, but if he be weakened by previous disease, by strong purgatives, or by excessive bleeding, he is speedily destroyed by a much less dose. (See *Bracey Clarke's Reformed Pharmacopœia for Horses.*) In this latter case, does it not appear that the fatal result depends upon the fact of the digestive organs having been disabled, by debility, from effecting that decomposition by which, under ordinary circumstances, the drug is disarmed of its potency?

* *Bitartrate of Potass* has been proposed as a remedy to remove the discoloration of the skin from nitrate of silver; and it is said to have been used with success. (*United States' Dispensatory.*) If so, it must have acted as an alkali.

† Dr. Wollaston observes that oxalic acid may probably exist in other vegetables or fruit than in the oxalis, and that we should, therefore, avoid such aliments as may be suspected of yielding it. Laugier has also sug-

decomposition,* since *Boracic acid* is a *binary* compound of boron and oxygen ; Liebig is, therefore, in error when he states that it is expelled as a *carbonate.*

36. We next pass to the consideration of the *metallic* salts. To Berzelius we are indebted for having been made acquainted with the manner in which metallic salts, or oxides, are absorbed from the intestinal canal, or the skin, carried into the circulation, dissolved in the serum, and expelled with the excretions. He states that this depends upon the chemical affinity subsisting between the oxide and albumen. If a small quantity of a metallic salt be mixed with serum, and a rather larger proportion of caustic potass be added than is necessary for the decomposition of such salt, the oxide is not precipitated, but remains in solution combined with the albumen. The salts of silver are well known, when given in repeated doses, to impart a dark tinge to the skin, and in explaining such an effect, a difficulty has arisen from the fact of *Hydrochloric acid*, or some of its salts, which are generally present in the stomach and alimentary canal, forming with the base an insoluble *chloride*, which it was conjectured must at once preclude the possibility of its absorption ; but it is rendered probable by the foregoing statement that it may combine with the albumen, at the moment of its developement, and, being carried into the circulation, be deposited, probably in the form of a *sulphuret*, in the skin.

37. The changes which the *Chloride of Mercury* (calomel)

gested that the use of aliments containing oxalic acid may, under certain circumstances, dispose to the formation of mulberry calculi. The habitual use of rhubarb may, on this account, be objectionable in cases where there exists a predisposition to calculus formations. Magendie and others have shown that where large quantities of the *Rumex, Oxalis Acetosella,* &c., have been used as food, the oxalic acid passes through the kidneys. In certain districts of France, where sorrel is much employed, calculi of oxalate of lime are said to be very common. Dr. Prout says he has often witnessed attacks of nephritic calculi of this kind follow the free use of the stalks of rhubarb.

* On the authority of Koehler. (*Tiedemann's Zeitschrift.*)

undergoes in the body are not so apparent; but it is difficult, on account of its insolubility, to explain its activity without supposing it to suffer some change in the first passages; and it is by no means improbable that, under certain circumstances, a portion of it is converted into *Bi-chloride.*

II.—BY AN IMPULSE CONVEYED THROUGH THE INSTRUMENTALITY OF NERVES.

38. While one class of physiologists maintain that all medicines which act generally upon the system, or upon any of its remote organs, can alone owe such operation to the actual absorption of the particles of the substance into the circulation, another with equal confidence assert that the remote action is solely due to an indiscernible influence transmitted along the nerves; and in each of these opposite ranks stand the names of equally distinguished physiologists, pathologists, and chemists.

39. Unless we admit the operation of nervous transmission, we shall leave many phenomena wholly unexplained. How else, for instance, are we to account for the instantaneous action of *Hydro-cyanic acid?* Its rapid influence is inconsistent with any explanation that the doctrine of absorption can afford. Sir B. Brodie accidentally touched his tongue with a glass rod which had been dipped in the essential oil of bitter almonds; scarcely had he done so before he felt an indescribable sensation at the pit of the stomach, great feebleness of limbs, and such inability to maintain his muscular balance, that he could scarcely keep himself from falling; now, whatever rapidity we may ascribe to the function of absorption, or whatever capability of rapid diffusion, from volatility or expansion, we may assign to *Hydro-cyanic acid*, it is scarcely within the compass of belief that such an effect should have been produced, except through the electric-like agency of the nerves. Then, again, how will the absorptionists explain the immediate

vomiting produced by certain odours?—but more of this hereafter.

40. Doctors Morgan and Addison have appeared in the field as mediators, and have proposed a theory with a view to bring the disputants to terms. In order to reconcile the conflicting experiments of those who refer all the phenomena to absorption, and of those who maintain the exclusive agency of the nerves, they at once admit the entrance of the medicinal substance into the bibulous vessels; but, instead of regarding the blood as the carrier, or medium of transmission to remote parts, they consider the expansion of nervous filaments on the inner surfaces of the vascular system as directly conveying the medicinal influence. They thus admit the conducting power of the nerves, but insist upon the necessity of absorption as an accessory operation.

41. Amidst such conflicting opinions, we may be allowed to quit the school of abstract experiment, and to call upon the practical physician to stand arbiter, for the lessons of the clinical ward will not unfrequently explain difficulties which can never be solved in the laboratory or dissecting-room. I think it will appear that medicinal bodies may occasionally act by absorption, as well as by nervous transmission. Without such a concession, we shall not only be unable to offer any probable theory of the operation of certain remedies, but we shall be compelled to array the facts of our experience in contradiction to each other; thus, if we exclusively adopt the theory of absorption, the rapid action of *Hydro-cyanic acid* opposes itself; if, on the other hand, we maintain the conducting powers of the nerves to the exclusion of all other agency, how comes it to pass that *Oxalic acid* is rendered more active by dilution? If a mechanical injury of an extreme nerve can convulse the whole system, as we observe in tetanus, why may not an impression by a medicinal agent be propagated through the same medium? Experience informs us that such is the fact, and Mr. Travers observes that "Prostration or mortal faintness and syncope, coma, convulsions, and tetanic spasm, are the

same affections, whether produced by the shock of a burn, or complicated injury, or by the *Prussic acid* or *Woorara*."

42. Admitting that medicinal impressions may be conveyed through the nerves to remote parts of the system, the next point of inquiry is into the circumstances under which such transits take place. It may be assumed that *an impression may be made upon the peripheral extremities of the nervous system.* It is thus by friction, electricity, blisters, and cold bathing, we stimulate the peripheral nerves, and, indirectly, the nervous centres; while, by soothing the former by tepid bathing, fomentations, &c., we allay the irritation of the latter. In some cases it would appear that we so far act *locally*, as by affecting certain nerves we produce an influence upon their ramifications and connexions, without the interference of a nervous centre; thus *Belladonna*, by coming into contact with the *Tunica-Conjunctiva*, will, by its action on the ciliary nerves, occasion immediate dilatation of the iris, although no other part of the system, not even the opposite eye, is in the least affected,—a clear proof that the impression does not reach the brain, for in that case we should have had a reflex action on the opposite eye.* Sir B. Brodie has observed that *Monkshood*, when chewed, causes a sense of numbness and tingling of the lips, which is quite unconnected with any general affection of the nervous system; I have frequently observed a similar effect from rubbing a minute portion of *Aconitina* or *Delphina* ointment on the under-lip. Other physiologists have observed analogous phenomena from *Hydro-cyanic acid* and *Opium*. *Lead*, again, appears to exert a local action;† there is a paper

* Müller observes that there exists a sympathy between the corresponding nerves of each side, through the reflex action of the nervous centre; it is thus that one eye being inflamed disposes the other to take on diseased action; tooth-ache on one side renders the opposite side susceptible, and deafness of one ear renders the other disposed to the same effect.

† It may also be absorbed; and the late interesting observation of Dr. Burton, that the gums of persons, under the influence of this metal, exhibit a peculiar blue appearance, indicating a specific action upon those

in the third volume of the *Medical Transactions*, by Dr. Reynolds, in which the case of a gentleman is detailed, who brought on a temporary paralysis of the *sphincter ani*, by freely using Goulard's lotion for the cure of piles; and the beneficial effects occasioned by the topical application of lead to inflamed surfaces seem to depend upon the same local action upon the peripheral nerves. On the other hand, it is evident that in many cases, by stimulating the peripheral nerves, we can convey an impression to a nervous centre, and from that excite a reflex action, or rebound to other different nerves, and to the parts which they supply. Frictions of the skin may thus stimulate the spinal cord. Blisters may relieve paraphlegia. The nerves of the skin may also propagate an impression to the stomach and other viscera. Dr. John Baddeley, an eminent physician at Chelmsford, communicated to me the following instructive anecdote:—"A gentleman complained that, on getting out of bed in the morning, and putting on his leathern breeches, he constantly vomited from the sensation of cold thus induced. My father, who was consulted on the occasion, recommended him to drink a glassful of *cold* water, before he commenced dressing; the advice was followed, and the person never afterwards experienced the same effect." It is upon the same principle that cold applied to the lower extremities will sometimes produce spasm of the stomach and bowels, while heat applied to the same parts will relieve it. I have known obstinate constipation at once overcome by dashing cold water over the thighs, and, in some instances, by a person suddenly quitting a warm bed, and standing upon a cold marble hearth. The popular practice of applying a cold key to the back, for the bleeding of the nose, affords another example of sympathy upon remote parts through the medium of the peripheral nerves. So, again, the dashing of cold water upon a person in asphyxia will, through the strong impres-

parts, not only proves the absorption of the metal, but may give force to the belief, long entertained, that its acetate is capable of checking mercurial ptyalism.

sion made upon the nerves of the skin, excite the diaphragm and its antagonist muscles, and thus restore the respiration. It is a well-known fact, that the recovery of dogs, which are made the subjects of experiment in the *Grotto del Cane*, is much promoted by their being plunged into a neighbouring lake. Hippocrates tells us, as a matter of experience, that the sight is obscured by wounds inflicted on the eye-brow, or a little higher; and the modern anatomist has shown the relations of the fifth pair of nerves to the retina, and hence the use of stimulating applications in the vicinity of the frontal nerve, and sternutatories to rouse the sensibility of an amaurotic retina.*

III. By the sympathetic control exerted by the stomach and alimentary canal on distant parts.

43. The term *sympathy* has been frequently objected to, as being too figurative; it is certainly a metaphor taken from an affection of the mind; but, as Sir Gilbert Blane† very justly remarks, "The import of words ought either to be assumed conventionally, according to a definition, or to be adhered to in the sense affixed to it by established usage. By *animal sympathy*," says he, "is not meant the intelligent principles of Stahl's hypothesis, (*Anima.*) but *that mutual influence of distant parts, so subtle and rapid, as in some instances to be compared to thought or lightning; while in other instances it is an action more slow and habitual.*" The truth is, that the term *sympathy* has been too frequently used to express relations not well understood, and therefore to comprehend phenomena of the most dissimilar character;‡ and this is an error to which I am the

* The sympathetic influence on these parts, through the medium of the fifth nerve, is shown by the act of sneezing being produced by the impression of a strong light.

† Medical Logic, 2nd edition, p. 123.

‡ M. Adelon (*Physiol. de l'Homme*) has rendered us much service by the manner in which he has treated this subject. He arranges the rela-

more anxious to direct the attention of the practitioner, as some important points of practice may turn upon it. The term sympathy ought to be restricted to that relationship, of which the nervous system would appear to constitute the medium; and although anatomy may not, in every case, discover a direct nervous communication between the sympathising organs, yet we may conclude, as Willis and Vieussens originally maintained, that such is the cause of the sympathy, unless it can be referred to some other source, as pointed out by Adelon—(*see foregoing note.*) If this be the nature of the sympathetic influence of the stomach, it may be fairly asked, why devote a separate division to its consideration, rather than

tions which subsist between the different parts of the body under three classes. 1. The MECHANICAL, as exemplified in the influence of the muscular action of respiration upon the pulmonary circulation. 2. The FUNCTIONAL, as illustrated by the secretion of bile, which cannot take place if the adequate supply of blood be withheld. 3. The TRUE SYMPATHETIC, or that relationship of which the nervous system would appear to constitute the medium. Some interesting observations upon the subject of sympathy may be found in Dr. Bostock's Physiology, vol. iii., and in a paper published in the second volume of the Edin. Med. Chir. Trans. by Dr. Alison, to which I beg to refer the reader.

Mr. Wardrop has pointed out a source of functional relation in the heart and brain, for, independent of the connexion which subsists between these organs by nervous fibres, their co-operation must in a great measure depend upon the blood. We may readily understand how a connexion, or relationship, may, through both the blood and nerves, be brought about; thus the stomach may affect the action of the heart by nervous influence, and the heart that of the brain by modifying the circulation; and the brain thus excited or depressed, may, in its turn, react upon other organs; and thus may the balance between the two great systems be restored or subverted. There exist also vicarious relations between secretory organs; the skin may thus antagonise with the kidneys, either one being called into extraordinary action by the apathy of the other; so again between the liver and lungs, both separate from the blood substances, containing a large portion of carbon; there may, therefore, very probably exist between them a reciprocity of action; in like manner costiveness may arise from too active a state of the cutaneous excretion, for more than one-half of the ingesta is carried off by transpiration, which must necessarily influence the alimentary discharges.

include it in the foregoing category? In the first place, because we are thus enabled to bring together a number of important facts that stand in intimate relation with each other, and which are capable of leading to conclusions of practical value; and, in the next place, because there exist between the stomach and other organs some very important relations through the medium of the circulation.

44. In order to appreciate all the bearings of this subject, the reader will do well to call to his recollection the situation and importance of that great nervous focus, the sympathetic system of ganglions, which more or less directly communicate with all the nerves of the body, and which especially supplies all the viscera of the chest and abdomen, in a manner peculiar to itself. He will then readily understand the extensive sympathies which the stomach must necessarily exert; and if, moreover, he considers the relations of its blood-vessels with those of the neighbouring viscera, he will at once perceive how an impression made upon it may become the means of exciting an action in the distant parts of the animal machine. Imbued with exquisite and diversified sensibilities—subjected to the first and coarsest impressions of our various ingesta—stretched occasionally to an enormous extent by the unrestricted indulgence of appetite—disturbed by the passions—exhausted by volition, and debilitated by the intensity of thought; in short, assailed from numerous foes from without, and harassed by various revolutions from within; let us not feel astonished at the aberrations of this viscus, nor wonder that it should give origin to a great proportion of those ailments with which we are afflicted; nor let us any longer feel sceptical with regard to the efficacy of those means that are directed for their cure through the medium of its sympathies. A dose of *ipecacuan*, by acting on the stomach, will abate both the force and velocity of the heart, and thus affect the whole series of blood-vessels, from their origin to their most minute ramifications, as evinced by the pallor of the skin under its operation, as well as by its power of arresting hæmorrhage.

The same effect will follow nausea, created by titillation of the fauces, in which case it is quite evident the phenomenon can alone be referred to nervous influence. In like manner, the brain, when disordered from defect of circulation, will frequently derive instantaneous relief from a teaspoonful of *æther*, or brandy, in a glass of water; and this effect will take place long before any absorption can be accomplished. Some time since I was in attendance upon a noble lady, whose heart occasionally failed in preserving an equable circulation through the brain. It so happened that upon the occasion to which these remarks more immediately apply, I was near her, when she suddenly fell back, and became paralysed on one side; the pulse was scarcely distinguishable at the wrist, and I immediately administered a dose of brandy; in the space of a few minutes the paralysis disappeared, the face regained its natural appearance, and she was apparently restored. Again, the phenomenon of hunger, and the circumstances under which it may be appeased, offer a striking proof of the immediate influence of the stimulus of food upon the nervous system, long before absorption, or even digestion, could possibly have been effected. The sudden prostration from a blow on the stomach, or from an injury occasioned upon it by a corrosive agent, might be adduced as affording additional testimony of the effects consequent upon a local action on the stomach and sympathetic system, in which the possibility of absorption is out of the question; so will a glassful of cold water frequently produce a copious flow of perspiration before it can have entered the blood-vessels.

IV.—By the operation of contiguous sympathy, or by that which is excited by mere proximity or continuity of parts.

45. This division, like that which precedes it, is rather suggested by views of practical utility, than by any theory founded upon an essential physiological distinction. Mr. Hunter,

however, acknowledged the existence of a distinct sympathy, which, as it appeared to depend upon the mere proximity and contiguity of parts, he termed "CONTIGUOUS SYMPATHY;" thus it is that relief is afforded to a deep-seated inflammation by scarifying the nearest external surface, while we learn from experience that the thoracic or abdominal viscera, when similarly affected, receive corresponding relief from the same topical use of bleeding, blistering, or fomenting; the extreme sensibility of the skin so frequently observed over parts affected by inflammation may be thus explained, as well as the fact of external hæmorrhage being arrested by the action of cold on the skin in its vicinity. In like manner are impressions made upon the stomach rapidly communicated to contiguous organs. The sympathy of *continuity* is shown in the affections of the skin; a spot acted upon by the *Potassio-tartrate of Antimony* will create a general eruption; a blast of cold air on a part will produce a shiver over the whole surface; in a similar way will heat, applied to particular parts, give a general glow; and a blister will sometimes be followed by cutaneous eruptions. I shall, however, have occasion to revert to this subject under the head of *Counter-irritation*, when it will be shown that this principle has its limits and modifications. There also exist pathological phenomena connected with organic changes in contiguous parts, which have never sufficiently attracted the attention of the physiologist—a species of *morbid induction*, if the expression may be allowed in the absence of one less objectionable. Thus, Dr. Hodgkin* observes, that the natural structures in the neighbourhood of malignant tumors are apt to degenerate into a substance in some respects resembling that of the original tumor; how far this may depend upon a specific chemical action, in accordance with the theory of Liebig, to be hereafter explained, upon a de-vitalized part, is a question well deserving inquiry.

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* Report of the Committee of the Medical Section of the British Association, held at Liverpool, 1837.

46. Such, then, were the different modes, or channels, of communication, by or through which the particular organs or tissues of the body may be acted upon by medicinal substances.

Whether bodies act through the medium of absorption, or through that of nervous transmission, is not a question of mere speculative curiosity, but one of real practical importance, inasmuch as the success of a remedy may depend upon the view we take of its *modus operandi*, and upon the scientific direction which our practice will receive from it.

47. It is important to observe that, although remedies may, in a general sense, be recognised as of similar tendency, unless they act through the same medium of communication, they may be medicinally incompatible with, and even adverse to, each other; for an illustration of this truth, let the reader refer to the observations offered under the history of *Diuretics*, *Diaphoretics*, &c.

48. In philosophical strictness, there are not two medicinal substances in the whole range of our materia medica perfectly similar to each other, although each may recede from the other by so insensible a shade that, for practical purposes, we may frequently allow their parallelism.* At the same time, let it be ever kept in remembrance that *those medicines alone are practically similar, whose operations have been found by experience to continue similar, under every condition of the human body; and which, moreover, owe such similarity to modes of operation which are compatible with each other, and consonant with the general indications of cure.* Arsenic and bark would appear medicinally similar in certain states of the body, as in ague, but, in other conditions, no two substances can be more dissimilar in their operation. Hence the failure of every attempt to classify the articles of the Materia Medica, according to their therapeutical effects. The observation of Dr. Duncan with regard to the bark will apply with equal propriety to

* The term *kindred* would, perhaps, more correctly express their relationship.

most of the substances in our list. Cinchona, he observes, is *Febrifuge*, if it stop an ague; *Antiseptic*, if it check gangrene; *Antispasmodic*, if it cure hysteria; *Anthelmintic*, if it expel worms.

49. The difficulty in distinguishing, with any degree of accuracy, between the primary and secondary operation of a remedy, opposes another obstacle to the construction of a therapeutical classification; however wisely framed, it can be nothing more than an artificial scheme to bring together phenomena, between which certain analogies have been established; but we have just shown that such analogies are nothing more than similitudes which present themselves to the observer when viewed in a certain situation; change but this situation, and the similitude vanishes.

50. Several distinguished authors, in despair of constructing a classification of medicines, founded upon their physiological or therapeutical distinctions, have proposed arrangements based upon their chemical or natural-historical properties; but what can such analogies have to do with their effects upon the living system? It appears to me that the greatest error that the physician can commit in his investigations into the powers of a therapeutic agent, is to confine himself within the circle of a specialty.

I have ever considered that a therapeutic arrangement, with all its errors and imperfections, is far preferable to one founded upon other analogies; indeed, its very imperfections will become sources of knowledge. The observation of differences is as instructive as that of analogies, and these are rendered most apparent when the objects of our examination are drawn up in rank and file.

51. To those who would repudiate all classification, and adopt an alphabetical arrangement, I have only to observe that, in describing the properties of the individual articles, such a plan is extremely convenient, and may be very usefully adopted in works on *Special* Pharmacology; but where our object is to investigate, philosophically, the *modus operandi* of

remedies, by rejecting classification we give up *trial by analogy*, and close one of the most important avenues to knowledge.

52. The classification of Dr. Cullen, founded upon the general effects of medicines, is, perhaps, with all its sins of *omission* and *commission*, entitled to our respect; and, in order that the observations I may have to offer may be rendered more intelligible to the reader, I shall here give a tabular view of it.

CULLEN'S ARRANGEMENT OF THE MATERIA MEDICA.

Medicamenta agunt in

- Solida.
  - Simplicia.
    - *Astringentia.*
    - *Tonica.*
    - *Emollientia.*
    - *Erodentia.*
  - Viva.
    - *Stimulantia.*
    - *Sedantia.*
      - *Narcotica.*
      - *Refrigerantia.*
    - *Antispasmodica.*
- Fluida.
  - Immutantia.
    - Fluiditatem.
      - *Attenuantia.*
      - *Inspissantia.*
    - Misturam.
      - Acrimoniam Corrigentia.
        - *In Genere.*
          - *Demulcentia.*
        - *In Specie.*
          - *Ant-acida.*
          - *Ant-alkalina.*
          - *Antiseptica.*
  - Evacuantia.
    - *Errhina.*
    - *Sialogoga.*
    - *Expectorantia.*
    - *Emetica.*
    - *Cathartica.*
    - *Diuretica.*
    - *Diaphoretica.*
    - *Menagoga.*

53. With regard to this classification, an objection may at once be taken to its two great divisions, based upon the gratuitous assumption that certain medicines act upon the *Solids*, and others upon the *Fluids* of the body; nor is the distinction between the action of remedies on the *Simple* and *Living* solids less hypothetical. Under the second division, we may justly question the existence of any class of medicines to which the term *Attenuant* or *Inspissant* can be fairly applied. It is also to be observed that the arrangement is alone founded upon the ultimate effects of medicines, having no regard to their specific action upon particular organs, or to their tendencies to affect particular structures.

54. The classification of Dr. Murray, although not less exceptionable, it is my intention to follow, as being valuable for its simplicity and perspicuity; and therefore well calculated to furnish a frame-work, if I may so express myself, for the display of those therapeutical distinctions, the knowledge of which I consider essential for the successful administration of remedies, and for the full comprehension of those practical doctrines which it is the great object of the present work to inculcate. It is my intention, also, to make several additions to the classes, and these I shall print in *italics*, that they may be readily distinguished. Into several of the classes I shall, moreover, introduce subordinate divisions, founded upon physiological relations of practical application.

CLASSIFICATION OF DR. MURRAY,

WITH CERTAIN ADDITIONS.

A. GENERAL STIMULANTS.

a. DIFFUSIBLE
- *Exhilarants—Excitants.*
- Narcotics.
- Antispasmodics.

b. PERMANENT
- Tonics.
- Astringents.

B. *CONTRA-STIMULANTS, OR SEDATIVES.*

C. LOCAL (OR SPECIAL) STIMULANTS.

Emetics.
Cathartics.
Emmenagogues.
Diuretics.
Diaphoretics.
Expectorants.
Sialogogues.
Errhines.
Epispastics.
Counter-Irritants.

D. CHEMICAL REMEDIES.

Refrigerants.
Ant-acids.
Antidotes.
Antiseptics.
Lithontryptics.
Escharotics.

E. MECHANICAL REMEDIES.

Anthelmintics.
Demulcents.
Diluents.
Emollients.
Laxatives.

F. *ALTERATIVES.*

I. GENERAL STIMULANTS.

56. Before we enter upon the consideration of this important class of remedies, it will be as well to pause, in order that we may distinctly understand the precise meaning to be attached to the term STIMULANT. As generally employed by authors, and understood by practitioners, it is far too vague and relative to convey any precise idea; and, were I called upon to select an example of the injurious influence which a mere *word*, inaptly applied, may produce upon the opinions and practice of the medical practitioner, that one word would be "*Stimulant.*" In its popular and generally accepted meaning, it denotes any influence which accelerates the vital movements of the sanguineous and nervous systems, and is thereby *supposed* to exalt the energies of the body; but action is not power. In the first place, let it be observed that, with the exception of what have been justly termed "*Vital Stimuli*," such as food, air, water, sleep, and heat, the whole range of the Materia Medica does not furnish a single agent which is capable of *directly* increasing the energies of the body, or of adding to the general stock of vital power. Man can no more create *Vital* than he can *Physical* force; it is true that, with regard to the latter, he can, to quote the observation of Mr. Babbage, "divert and accumulate a portion of that supplied by nature to his own particular uses, BUT HE CANNOT CREATE IT." So, in the living economy, the physician can refresh languid organs, give tone to relaxed textures, and recruit declining strength; not, however, by adding an *iota* to the existing aggregate of vital force, but by removing the impediments to its full play and operation; by favouring its more equable diffusion, and thus restoring a lost balance; or by favouring its accumulation in particular organs, by its abstraction from others; in short, so to speak, by drawing upon one part for the relief of another. Such is the sense which, in a philosophical point of view,

should be affixed to the term stimulant. Our misconception of the term has arisen from a partial and superficial view of the *immediate* effects of a few limited agents, of which brandy may be taken as their type; it produces a temporary excitement of the arterial and nervous systems, but this is invariably followed by a corresponding depression; all that we have done then is to disturb the balance, we have added nothing to the general amount of power. It may be asked whether we are incapable of increasing the vigour of the system by remedies? My answer is, that from the phials of the laboratory we cannot infuse into the living body any such specific elixir; we cannot, *directly*, increase the *vis vitæ;* but, by removing the obstacles which oppose the effects of nature, we can enable her to do so. There is scarcely a remedy, therefore, that might not properly fall under the designation of a stimulant; thus, congestion may take place in a nervous centre, and the whole system, in consequence of the oppression, exhibit symptoms of declining power; in such a case, *Venesection* is a stimulant. The two most essential processes of animal life are nutrition and excretion, and these are exclusively performed by capillary vessels; suppose the balance of their circulation to be disturbed; mercury, by restoring and equalizing it, might, in certain cases, prove a true stimulant. The body may also exhibit symptoms of languor from intestinal and biliary accumulation; under such circumstances, a purgative assumes the character of a stimulant. The nervous system may be in a condition that repels sleep; a judicious and well-directed narcotic, inasmuch as it affords the means of indirectly giving power to the body, may be correctly considered as a stimulant. We may also imagine a state of the body in which the *Vital Stimuli*, the only true source of power, are inoperative; in which case, our medicinal stimulants may supply such temporary force as will enable the machine to continue its operations, until the morbid causes shall have passed away. Examples of the benefit to be derived from such a practice are too obvious to require enumeration. Syncope, or faintness

from hæmorrhage or other causes, requires a diffusible stimulant to keep the heart in action, until the vital powers are restored.

56. If, then, the operation of a *Medicinal* stimulant be that of enabling the body to avail itself of the full benefit of the *Vital* stimuli, by removing the impediments to their action, we must at once perceive how imperfect must be every classification that does not acknowledge pathology as its foundation.

57. From the too common error of mistaking action for power, and of regarding that which is, in fact, only borrowed, for an actual increase of capital, the practitioner has often concluded, that debility and stimulants (I use these terms according to their popular acceptation) constantly stand towards each other in the relations of Disease and Remedy; the same false reasoning will also lead him to conclude that a debilitated patient can never bear depletion, forgetting that the weakness may be the effect of disease, the removal of which can alone restore strength. The practical applications of these views are as numerous as they are important, and we shall have frequent occasion to refer to them.

58. According to Dr. Murray's arrangement, stimulants are divisible into two classes; viz. 1. Into those which are DIFFUSIBLE; and 2. Those which are PERMANENT: a distinction of no small importance in its practical bearings. The former rapidly diffusing their influence, and urging forward the vital movements, and being as quickly succeeded by a collapse, or exhaustion of power; while the latter, on the contrary, so slowly and almost imperceptibly acting on the living body, as to allow the restorative influence of the *Vital Stimuli* to keep pace with the increased expenditure they may have occasioned, and consequently to prevent the occurrence of collapse.

59. Diffusible stimulants, although they differ from each other, both in their primary and secondary effects, still possess so many qualities in common, and present such a general similitude, as to justify their arrangement under one comprehensive division. They all produce a rapid but transient

increase in the action of the vascular and nervous systems, followed by symptoms of collapse; but the specific nature and extent of the secondary effects vary essentially in the different orders, and hence sanction the distinctions of Exhilarants, Narcotics, and Antispasmodics.

EXHILARANTS.

60. It is a great defect in the classification of Dr. Murray, that no distinct place is assigned to an order of Diffusible Stimulants that cannot properly fall under the denomination of either Narcotic or Antispasmodic, nor be correctly assimilated with that of Tonic, since their practical value depends upon the rapidity of their action. It is true that the vegetable bodies which constitute the class of *Aromatic Stimulants* are very intimately related to, though very distinct from, that of Tonics; indeed, in many of the more efficient vegetables of the latter kind, the two qualities are very generally blended, as we shall hereafter have occasion to remark.

61. They are generally characterized by a fragrant smell,* and produce upon the organ of taste a peculiar sensation of warmth and pungency, and occasion, when swallowed, a corresponding impulse upon the stomach, which is rapidly communicated to the remote parts of the body.

62. Those derived from the vegetable kingdom are indebted for their virtues to the presence of an essential oil, or resin. Ammonia, spirit, and ether, may be regarded as products of art.

63. Medicines of this kind, when administered for the purpose of dispelling flatus from the alimentary canal, have been termed "CARMINATIVES."† They would seem to act by

* αρωμα, which is compounded of αρι, *very*, and οδμη, or οσμη, *smell*.

† The origin of this term is to be traced to the superstitious custom of curing such complaints by incantations in verse, (Carmina,) or perhaps it

imparting a sudden stimulus to the distended muscular coat of the stomach and intestines, by which the accumulated gas is propelled through the upper orifice, or carried downwards, and discharged *per anum;* for this tube, like the bladder, when greatly distended, becomes unable to relieve itself partly in consequence of the exhausted state of its overstretched fibres, and partly, perhaps, from a contraction of the *cardia;* for spasmodic action is not unfrequently associated with loss of power.

NARCOTICS.

SYNON.—*Anodynes—Hypnotics—Soporifics.*

64. Substances which, in moderate doses, occasion a temporary increase of the actions of the nervous and vascular systems, but which is followed by a greater depression of the vital powers than is commensurate with the degree of previous excitement, and which is generally followed by sleep.* In large doses, the symptoms of diminished sense and action follow so immediately, that the previous stage of increased action is very obscure, or not in the least perceptible.

65. These facts have led many physiologists to deny the stimulant nature of Narcotics, and to consider their primary operation as one of a depressing kind; and hence to arrange them under the general denomination of SEDATIVES. If we refer to the classification of Cullen, (p. 166,) we shall find that the arrangement of these bodies has been directed in strict conformity with such a view of the subject; but it may be asked, how the increased excitement and exhilaration which

may be understood metaphorically, as expressive of the instantaneous relief which these medicines are capable of affording; operating, as it were, like a charm.

* Narcotics, from *νάρκη, torpedo,* an animal which has the power of *stupefying* any animal that it touches.

so obviously follow the administration of these bodies, in small doses, can be reconciled with the theory which regards them as absolutely and *primarily* sedative? In order to combat an argument so fatal to his hypothesis, Dr. Cullen summons to his aid the potent intercession of his tutelar deity, the "*Vis Medicatrix*"—a power which he supposes to preside over the living body, and with anxious violence to resist the invasion of everything that is noxious, or hostile to its health and well-being; with such assistance it was not difficult to explain any paradox in physiology; and the anomalies attending the agency of narcotic medicines were accordingly, in the school of Cullen, easily reconciled with the views of a favourite theory. He supposed that whenever a "*Sedative*" was applied in a moderate dose, the "*Vis Medicatrix*" took the alarm, and excited all the powers of the system, in order to throw off the noxious application, and that thus *indirectly* arose those peculiar symptoms of increased action; but when the dose was more considerable, he contended that the conservative power of the system was silenced, and unable to offer any salutary resistance, and consequently that universal depression immediately followed. But there is no direct evidence in support of the existence of such a power, and still less of its influence upon such occasions; it is far more philosophical to refer the operation of narcotics to a peculiar stimulating power, remarkable for the extreme rapidity with which it exhausts the energy of the nervous system. No one will deny the stimulating power of alcohol, and yet a very large draught of this liquor will occasion extreme exhaustion, even to the extinction of life, without the occurrence of any signs of previous excitement; nor will any one be disposed to question the depressing influence of opium, and yet small doses have enkindled excitement, and sustained the powers of life, under circumstances of extreme and alarming exhaustion. During the severe campaigns of the late war the surgeons of the French army were in the practice of administering opium and cayenne pepper to the soldiers who were exhausted by fatigue; and it is well

known that the votaries of fashion in this town have been in the habit of taking opium to sustain their powers under repeated dissipation; while it is to be feared that those who, from various motives, have abjured the use of spirits, may have contracted the habit of taking opium* as a substitute, for by a due regulation of this drug as to dose and repetition, the exciting influence is continued without the occurrence of depression or sleep. By some of the oriental nations it is employed for the same purposes that we take spirituous potations: by the Turks, especially, to whom our more generous beverages are prohibited by a religious ordinance. It is solicited to inspire courage, to soothe sorrow, or to dissipate the remembrance of misfortune; to awaken the fancy to more brilliant exertions; or to create that mild composure and serenity of feeling which is desirable after the cares and solicitudes of an active, perplexing, and arduous scene; it is, in short, the support of the coward, the solace of the wretched, and the daily source of intoxication to the debauchee.

65. Narcotics, of which opium is the most powerful and definite, are medicinally employed either for their primary or secondary effects, that is, as stimulants or sedatives; their application, therefore, like that of other remedies, will be judicious or otherwise, according to the indications of the case, and the manner in which they are adapted to answer them; but I apprehend that there is no class of medicines, whose specific effects are so entirely dependent upon the dose; and we may possibly ascribe the diversity of opinion that has existed upon the propriety of administering opium in inflammatory affections, to the opposite effects produced by different doses. Again, where our object is to allay pain, and relax spasm, small doses will have a tendency to aggravate the symptoms, whereas in larger doses they will be speedily re-

* The consumption of opium in this country is evidently upon the increase. In 1838, 95,832 lbs. were imported, of which 31,204 lbs. were of home consumption; in 1839, 196,246 lbs. were imported, the home consumption of that year having increased to 41,671 lbs.

lieved; as, for instance, in the passage of calculi, or gall-stones.

66. In conclusion, it may be observed, that there is probably no class of medicinal bodies, the individuals of which are less disposed to bend and conform to an artificial arrangement; each would seem to have its own particular mode of operation, and to affect sensibility in its own peculiar manner; and hence the practitioner will often find that, after the failure of one narcotic, the administration of another will induce sleep or tranquillity. It must also be remarked that the three classes of diffusible stimulants, however much the individual substances of each may differ, are not separable from one another by any very broad or well-defined distinction; Alcohol, which is properly arranged under the class of Exhilarants, or Excitants, might, without any violation of principle, stand at the head of Narcotics; and there is scarcely a narcotic that might not with equal propriety fall under the denomination of an anti-spasmodic remedy.

CONTRA-STIMULANTS, OR SEDATIVES.

67. However ingeniously the theorist may have attempted to identify Sedatives with Narcotics, so as to include them under the same artificial division, the practitioner who has carefully observed and compared the effects of these agents must withhold his assent to such an alliance. A *Sedative*, in whatever dose it may be given, is never followed by the slightest indication of excitement: it directly and *primarily* depresses the powers of life, whereas a narcotic in small doses never fails to increase the vital force. It therefore appears to me to be practically essential that we should recognise a class of agents so evidently distinct from all others; not for the sake of giving support to a particular theory, but to warn the practitioner against an error of practice,—that of combining

in the same prescription remedies obviously incompatible, from a belief in the similarity of their operation; suppose, for instance, our object was to allay irritability by *Hydrocyanic acid*, would it not be inconsistent to combine it with a small dose of opium, or a more considerable one of alcohol, or of ammonia?

68. It is difficult, and perhaps not necessary, to frame such a theory as shall satisfactorily explain the *modus operandi* of Sedatives; we are naturally inclined from analogy to infer that all vital changes are brought about by active impressions, and it is not easy to imagine the diminution, or extinction of a power, except as the consequence of exhaustion; thus much, however, is certain, that some material change is immediately produced upon the nervous system, by which it ceases to be acted upon by the ordinary stimuli; its excitability is therefore diminished, or destroyed; and this, not as in the case of narcotics, from a stimulus having rapidly exhausted the nervous power, and left the body in a state of collapse.

ANTISPASMODICS.

69. Substances which are supposed to possess the power of allaying the inordinate action of muscular structures.

70. Before we can determine how far we are justified in recognizing any distinct class of bodies, as capable of *specifically* controlling spasmodic action, we must possess an accurate notion of the nature of spasm, and of the causes by which it is produced.

71. Spasm may be defined, a temporary, irregular, and involuntary action of muscles, attended with more or less pain, and followed by exhaustion.

72. The general cause would appear to be morbid impressions upon the nervous system, of which the following are the principal exciting causes.

73. 1. *Irritation of the nervous centres.*

2. *A loss of balance between the nervous and sanguineous system.*

3. *Irritation in the primæ viæ.*

4. *Cold.*

5. *Excessive muscular re-action excited by over extension.*

6. *A laborious effort to expel foreign matter.*

74. This view of the subject will necessarily lead to the conclusion that the successful treatment of spasm will depend upon the skilful adoption of such means as may be capable of removing the cause of nervous irritation, rather than upon remedies which may be supposed to exert any specific control over muscular action; and such, undoubtedly, is the line of practice which the skilful physician will pursue. Indications of a plethoric or inflammatory condition of the brain or spinal marrow, will be met by depletion; while symptoms announcing a defective state of the sanguineous system, for spasm may equally arise from these opposite conditions, will be combated by an appropriate treatment. From the well-known power of narcotics in allaying irritation and pain, they will necessarily furnish important resources, and, by rendering the nervous system less susceptible of noxious impressions, will frequently act like a charm in resolving spasm. Are we led, then, from these views, to exclude from our arrangement that class of remedies properly termed *Antispasmodics*, according to the accredited definition; or are they to be regarded as synonymous with narcotics? I shall endeavour to answer these questions.

75. There are certain medicinal agents which appear to exert a specific control over spasmodic action, independent of any influence upon its exciting causes; such are *Assafœtida*, *Galbanum*, *Musk*, *Castor*, *Ammonia*, *Camphor*, *Valerian*, &c.; and

it is remarkable that, although they repress inordinate muscular action, and resolve spasm, by a stimulating operation, for the pulse is quickened under their action, their administration is not followed by that diminished sensibility and collapse which characterise the effects of a narcotic. To account for this difference, it has become a question which, however curious in a physiological point of view, does not open any views of practical interest, as to whether narcotics may not differ from antispasmodics in directing their influence upon a different class of nerves, the former acting upon nerves of sensation, the latter upon those of motion.

76. The influence of the mind, and the power of volition, in increasing or allaying spasmodic action, present some interesting points of inquiry, and may explain the occurrence of phenomena not otherwise intelligible.

77. In approaching this question, we are at once carried back to a subject to which the reader has already been directed —"*the effects of mental attention on bodily organs.*" (*See note, p.* 29.) To illustrate the fact that spasmodic action may be maintained by the earnest attention of the sufferer being steadily directed to the affected muscles, the following case has been adduced:—A man has his shoulder-joint luxated; and, after various attempts, the luxation cannot be reduced on account of the spasm that has supervened, and which is maintained by the attention of the patient being directed solely to that part; but abstract the attention, and the spasm instantly yields, and the head of the humerus slips into the socket. In like manner, by concentrating the attention upon any other set of muscles, and thus directing the stimulus of volition from those affected, the spasm may be resolved. Upon this principle we may explain the beneficial effects which are said to arise in cases of cramp, from forcibly squeezing a roll of brimstone, which from the warmth of the hand soon snaps; the popular belief that this fracture is, in some way, connected with the antispasmodic virtues of the substance, is absurd: the only medicinal power of the brimstone consists in afford-

ing an object for the hand to grasp vehemently, by which we collect and concentrate the irritable powers in a set of remote muscles. The sudden application of cold, by the affusion of water, may, upon the same principle, afford relief; a spasmodic constriction of the skin is thus produced, and a transfer of the spasm from a particular part to the general surface effected.* The same practice, however, under different circumstances, may produce internal spasm, as already explained. (42.)

Those who have ever suffered cramp in the voluntary muscles must be well aware, after its subsidence, how readily it may be re-excited by constantly directing the attention to them.

TONICS.

78. Substances, whose continued administration gives strength and vigour to the body, without producing sudden excitement, or subsequent depression.

79. When the vital movements have been accelerated by a stimulant beyond a certain point, the consequence will be a corresponding collapse, as already explained, (58,) and an interval must elapse before the exhaustion can be supplied, and the natural balance re-established through the agency of the *Vital Stimuli;* not so, however, with Tonics, for as they act slowly, and yet progressively, time is allowed for the full operation of the vital stimuli to supply an influx of power which shall, at least, equal the demand for it, and consequently no collapse can take place; but more than this is effected, for since the re-animating or restorative functions will necessarily

* In connexion with this subject the reader will find much ingenious speculation in Dr. Darwin's Zoonomia. (Sect. xxxiv. *Diseases of Volition.*)

partake of the general excitement, they will be urged with increasing activity, and thus, as it were, by an ascending scale, will the energies of every part be gradually and permanently increased, and the general standard of strength raised. To insure, however, this desirable result, we must be careful so to regulate the application of the vital stimuli, by a judicious system of *medical training*, as shall ensure the full benefit of their revivifying influence. Such is the theory by which I propose to explain the operation of tonics, and the phenomena will be found to correspond with it; thus, to the above conditions there must evidently be a limit; when the powers of the system have been urged to a certain amount, or as far as may be consistent with its well-being, the tonics assume the character of an excitant; the vital stimuli are no longer adequate to the demand made upon them, and indications of collapse present themselves. Every practitioner of experience must have observed in the course of his practice, that, after the protracted use of a tonic, its beneficial effects have not only ceased, but that the original debility has even returned. I have frequently witnessed such an effect in cases where the patient has consulted me at distant intervals, during which he has continued a prescribed tonic; in the same manner, a too protracted use of a chalybeate water has been succeeded by a return of that state of debility for the cure of which it was directed. For similar reasons, if the tonics be given when the powers of the system are at their *maximum*, it assumes the character of an excitant, and its administration is followed by collapse. The practitioner, from these brief remarks, will be led to exhibit tonics with caution, and will feel that much more judgment and circumspection will be required than is usually displayed on such occasions. The fatal error, before noticed, (57,) of regarding symptoms of weakness and tonics as constantly standing towards each other in the relations of disease and remedy, has too often led the routine practitioners into a most injurious course of practice:—loss of appetite, or general lassitude, has too generally been the signal for

tonics; but should these, as frequently happens, be accompanied with symptoms of gastric irritation, such as a dry and sometimes red tongue, with or without thirst, with fulness of the epigastrium, the chances are that the disease will, by such means, assume a more inveterate character. In certain affections of the heart, the patient will often present to the superficial observer that combination of symptoms in which tonics, under other circumstances, are most beneficially given, whereas in such a case they would be highly injurious; headache, cough, oppressed breathing, and increased lassitude, would be the probable consequences of such a treatment.

80. The evils arising from the injudicious use of tonics are endless. How usual is it for a patient to present himself to a physician, full of lamentations as to loss of appetite, increasing debility, and feelings of inexpressible discomfort, *notwithstanding his perseverance in strengthening medicines and nourishing diet!*—the very plan he ought to have avoided. A course of alteratives is given—purgatives judiciously interposed — the diet regulated—stimulants withdrawn; and the patient, to his astonishment, acquires strength from a plan calculated, in his ideas, to diminish it. There is no *functional* deviation from health that produces greater prostration of the powers of life than a depraved state of the secretions; and it should be a universal maxim, never to admit tonics, until we have satisfactory evidence upon this point. Before prescribing a tonic, the *primæ viæ* should be carefully cleared of all foul congestions, and even during its use an occasional mild aperient, such, for example, as rhubarb, which combines a tonic with its laxative quality, may be interposed with advantage.

81. In explanation of the operation of tonics it has been affirmed, that a state of permanent tension in the fibres of the body is necessary for the existence of life, and that any undue departure from such a condition is followed by debility; thus, Sir Gibert Blane observes, that no muscle, whether voluntary or involuntary, can act unless its fibres are previously in such a state that, if divided, they would shrink by their own

resiliency, leaving an interval between the cut extremities; the same may be said of the vascular system in all its ramifications, in order to give play to their contraction in grasping and propelling their contained fluids. To this proposition we must certainly give our assent, nor can we question the fact that certain medicinal bodies have the power of affecting this state of tension, and when they contribute to its restoration, they are properly denominated *tonics*. We are, however, not entitled to consider them as producing such a change by any chemical or mechanical operation upon the matter of which the fibre consists, but by a peculiar action upon its living principle; it seems also probable that certain poisons may produce sudden death by their agency on the vital principle, by which the tension of the heart and whole arterial system are immediately relaxed.

82. Before we attempt to remedy, by the resources of art, any state of general debility, we must endeavour to ascertain the causes from which it has arisen. Tonics, like the other remedies which we have considered, are *relative* in their operation; a bitter tonic may cure diarrhœa, or obviate costiveness, according to the condition of the alimentary canal. Venesection, purgation, or whatever will, in certain states of the system, occasion a salutary change in its vital powers, may produce a corresponding alteration in the tension of its fibres, and consequently fall under the denomination of a tonic remedy. The debility may have been produced by a negligent or injudicious regulation of the vital stimuli; as more particularly included under the general heads of diet, air, exercise, and sleep; if so, an alteration of habits may be all that is required for a cure.

83. It has been stated, (81,) that there are certain medicinal bodies that would appear to act *specifically*, and are in particular cases indispensable for the maintenance of healthy tone; such are vegetable bitters, derived from particular plants, which produce a powerful effect upon the digestive organs, and, by nervous sympathy, upon the rest of the system. We

are all conscious of the invigorating effects of slight bitters upon our stomach, and their presence in malt liquors not only tends to diminish the noxious effects of such potations, by counteracting the indirect debility which they might be liable to occasion, but even to render them, when taken in moderation, highly acceptable to the stomach, and efficient promoters of digestion. The custom of infusing bitter herbs in vinous drinks is very ancient and universal; the *Poculum Absinthiatum* was regarded in remote ages as a wholesome beverage, the wormwood being supposed to act as an antidote to drunkenness. The Swiss peasant cheers himself amidst the frigid solitude of his glaciers with a spirit distilled from *Gentian*, the extreme bitterness of which is relished with a glee which is quite unintelligible to a more cultivated taste, and perhaps less acceptable to a stomach accustomed to more nutritive and digestible aliments. With regard to the natural use of *bitter extractive*, it may be assumed as a general proposition, that it stimulates the stomach, corrects putrefying and unwholesome nutriment, checks acetous fermentation, promotes tardy digestion, increases the nutritive powers of those vegetables with which it is naturally united, and furnishes a remedy for the deranged functions of the stomach in general, and, through the sympathetic medium of that organ, for the atony of remote parts in general; and I shall hereafter show, that in its medicinal applications it is certainly capable of imparting additional activity to many remedies, while it will render the stomach and system more susceptible of their salutary impressions.

84. *Bitter Extractive* would appear to be essential to healthy digestion in *Herbivorous* animals, acting as a natural stimulus to their organs, for it has been shown by a variety of experiments, that it passes through the alimentary canal without suffering any diminution in its quantity, or change in its nature. No cattle will thrive upon grasses which do not contain a portion of this vegetable principle; this fact has been most satisfactorily proved by the researches of Mr. Sinclair, gardener to the Duke of Bedford, which are recorded in that

magnificent work, the "HORTUS GRAMINEUS WOBURNENSIS." They also show that, if sheep are fed on *yellow turnips*, which contain little or no bitter principle, they instinctively seek for, and greedily devour, any provender which may contain it, and that if they cannot so obtain it, they become diseased and die. As an ingredient in vegetable provender, I think it may be admitted as a fact, that its importance is in *an inverse ratio with* the nutritive powers of the food; thus, Sir H. Davy, in comparing the composition of the soluble products afforded by different crops from the same grass, found, in every trial, the *quantity of truly nutritive matter*, and the *least proportion of bitter extractive* and saline matter, in that cut when the seed was ripe; while in the autumnal crops these relations were uniformly found inverted, (*Elements of Agricultural Chemistry.*) In accordance, therefore, with that universal scheme of self-adjustment and compensation, which influences all the operations of nature, we find that cultivation, which extends the nutritive powers of vegetable bodies, is generally found to diminish their bitterness. The natural history of the potato offers a striking illustration, for the roots, which have been so greatly improved by culture, are, in their wild state, both small and *bitter*. Molina, in his History of Chili, speaking of the potato, says, "It is indeed found in all the fields of this country, but the plants that grow wild, called by the Indians *Maglia*, produce only very small roots of a *bitter* taste." Dr. Baldwin also found the wild parent of the potato plant at Monte Video; and Mr. Lambert informs us that this statement has been confirmed by Captain Bowles, during his residence at the South American station; he says, "It is a common weed in the gardens, bearing small tubers, but too *bitter* for use. (*Royal Institution Journal*, No. xix.) Gummy matter, which seems to result from the first change of the sap, is undoubtedly rendered more digestible and nutritive by the presence of a *bitter;* pure gum is not very much disposed to yield to the assimilative functions; "it frequently passes

through the bowels," says Dr. Chapman, "very little changed,* as I have witnessed a thousand times." We may infer, therefore, the value of the bitter principle in the *Lichen Islandicus*, as an article of food for animals in northern latitudes. We are also told that boiled linseed constituted the sole diet of the people of Zealand during a scarcity of long continuance, on which occasion, symptoms of great debility occurred, attended with those of dyspepsia; so again, Professor Fritze, in his Medical Annals, states that vegetable mucilage, when used as a principal article of diet, relaxes the organs of digestion, and produces a viscid slimy mucus, and a morbid condition of the primæ viæ; it is probable that such effects might have been obviated by the addition of bitter extractive. For the same reason, animals that feed in marshy lands on food containing but little nourishment, are best defended from the diseases they are liable to contract in such situations by the ingestion of bitter plants; thus has it been found that the *Menyanthes Trifoliata*, (the Water Trefoil,) which, on account of its bitterness, has been used as a substitute for hops, is a cure for the rot in sheep, when given in doses of a drachm of the powdered leaves; and Dr. William Bulleyn, the contemporary of Turner, the father of English botany, observes in his work, entitled "The Bulwark of Defence," that *Tormentil* in pastures will prevent the rot in sheep. Upon these occasions nature would appear to be very kind, for the particular situation that engenders endemic disease, is generally congenial to the growth of such plants as operate as antidotes. I formerly offered these remarks upon the subject of *Bitter Extractive*, from a conviction that they might contribute to the establishing just and philosophical views respecting the *modus operandi* of many vegetable tonics; but I never intended to assert that *bitterness* is essential to all tonics, or, in other words, the Tonic principle; nor did I ever maintain, as Dr. A. T. Thomson appears

* Discourses on the Elements of Therapeutics and Materica Medica, by N. Chapman, M.D., Philadelphia, 1819.

to have inferred from my observations, that without *bitterness* no vegetable could possess tonic properties. I am also well aware that there are many different kinds of bitterness, different both with regard to chemical composition and medicinal property; some are highly purgative, others eminently poisonous; and yet I am by no means prepared to say that, in all cases, the difference consists in a real opposition of quality, rather than in a relative degree of intensity. Aloes purge, but in minute doses I am disposed to regard them as tonic; the *Decoctum Aloes compositum*, in doses insufficient to produce purgation, certainly possesses such a property; on the other hand, the salts of *Quina*, although eminently tonic, have, in excessive doses, produced palpitation and even syncope; while *Strychnia* in very minute doses will display tonic powers, probably by stimulating that portion of the nervous system, upon the due action of which muscular tone has been supposed to depend, viz. the *Spinal*, or "*Excito-motory*" system of Dr. Marshall Hall. I am also well satisfied that certain metallic compounds, not characterized by bitterness, act as tonics; although, in connexion with my previous remarks, I incidentally alluded to the bitterness which distinguished that metallic tonic, as a coincidence worthy of notice.

ASTRINGENTS.

85. Substances which, when applied to the living body, corrugate and condense its fibres, and at the same time exert a tonic influence through the medium of its living principle.

86. If the above definition be admitted, it is evident that no very broad line of distinction can be drawn between astringents and tonics; and indeed such an inference has the support of experience, since tonics occasionally act as astringents,

and astringents as tonics. There is, however, this obvious difference, that, although tonics increase the tension of muscular structures, the effect is slowly produced, whereas astringents cause sudden contraction, and on that account more nearly approach the character of a diffusible stimulant, and yet they materially differ from it in not being followed by collapse.

87. Astringency in any substance may be at once recognized by the organs of taste; the property of corrugating the papillæ of the tongue, and of imparting a sensation of harshness and roughness to the palate, being too peculiar to be mistaken. This is fortunate, for there does not exist any one chemical test by which we can invariably detect the presence of an astringent quality, since it is found to reside in many different classes of substances; thus, mineral acids are powerfully astringent; so are many of the metallic salts, as those of iron, zinc, copper, and lead; and some of the earths, when combined with acids, of which alum is a striking example. The vegetable kingdom, however, furnishes the greater number of astringent remedies, and chemistry has shown that this property depends upon a peculiar proximate principle, characterized by its forming with animal gelatine an insoluble compound, (*Leather*,) and with the solutions of the salts of per-oxide of iron precipitates of a deep blue colour. To this principle the name of Tannin, or more lately, Tannic Acid, has been given. With this there is another acid, with one or two exceptions, universally found associated, viz. Gallic Acid; the presence of which has occasioned considerable confusion, as it was doubtful to which should be attributed the astringent principle of the vegetable, since it was difficult so entirely to separate one from the other as to submit them to the test of experience.* Like the tannic

* Tannic acid may be procured sufficiently pure for every medical object from *Catechu*, which is generally free from gallic acid, although Dr. Bostock found traces of it in a specimen which he examined. For this purpose, a solution of the substance in cold distilled water should be filtered, and then evaporated to dryness in a water-bath. When pure, it is colourless; its taste is extremely astringent, without any bitterness. It has no smell. Water dissolves it in considerable quantity, and the

acid it precipitates the per-oxide of iron, but it does not precipitate gelatin, nor does it disturb the vegetable alkaloids. It is however astringent, and would appear to increase the astringency of the tannic acid, with which it is so generally associated. Recent experiments, however, have shown that tannic is readily converted into the gallic acid, by the action of the air; thus, according to Richter, galls do not contain more than 3·5 per cent. of their weight of this acid, and yet, if the solution be left to spontaneous decomposition, it will yield 20 per cent.; and it has been long known to chemists that the only way of obtaining it in any considerable quantity from the infusion is to leave it, covered with paper, to spontaneous decomposition. Pelouze* is even of opinion that galls do not originally contain any gallic acid, but that what is obtained from them is formed by the action of the air on their tannic acid;† if so, this acid must be regarded as a *pro-*

solution reddens litmus. It decomposes the alkaline carbonates with effervescence, and forms, with most of the metallic solutions, precipitates which are *Tannates*. Salts containing only *Prot*-oxide of iron are not disturbed by it, but it precipitates the *Per*-oxide of that metal of a deep blue colour. The practitioner should know that the salts of *Cinchonia, Quina, Brucia, Strychnia,* and *Morphia,* form, with the solution of tannic acid, white precipitates, very little soluble in water, but very soluble in acetic acid.

* The accurate experiments of Pelouze and Liebig have not only proved the ultimate atomic composition of these acids, but have shown how tannic acid, by the appropriation of oxygen, may be converted into gallic acid, carbonic acid, and water, thus:

2 Atoms of tannic acid = $(C^{36}\ H^{18}\ O^{24}) + O^{30}$

are equal to

3 Atoms of gallic acic acid .	$C^{21}\ H^{9}\ O^{15}$
15 ——— carbonic acid . .	$C^{15}\ \ O^{30}$
9 ——— water . . .	$H^{9}\ O^{9}$
	$C^{36}\ H^{18}\ O^{54}$

Hence every two atoms of tannic acid absorb 30 of oxygen, and are resolved into 3 atoms of gallic acid + 15 carbonic acid + 9 of water.

† Liebig imagines that it is the very finely divided woody fibre, in the act of decay, which in moistened gall-nuts converts the *Tannic,* with such rapidity, into the *Gallic* acid, just as a piece of decaying wood, by

duct rather than an *educt*. To have drawn a distinction between these acids is a point of some importance in the history of vegetable astringents, and may suggest precautions essential to their due preparation.

88. Dr. Cullen proposed to explain the *modus operandi* of vegetable astringents, on the principle of their action in the process of tanning. We may, perhaps, venture to admit that, in certain cases, in which the remedy comes into direct contact with a morbidly secreting surface, some such chemical effect may be produced,* but, in general, they must be regarded as *vital* agents, influencing the living principle of the structures upon which they act; it may be that they stimulate the ultimate fibrils of the motor nerves, and through that medium condense the muscles; in like manner they may act as stimulants or sedatives upon the nerves subservient to the organs of secretion, and thus produce salutary changes in their functions. Lead, one of our most powerful astringents, has obviously a sedative operation, and the same may be said of the application of *cold*. In confirmation of the theory that the increase of muscular density by astringents is the effect of their action upon the living, rather than upon the physical, condition of the structure, experiment has proved that a muscle, under the influence of nervous power, will sustain a weight that would at once overcome its cohesion, and lacerate its fibres, after death. Astringents, moreover, are capable of acting as tonics, of curing intermittent fevers, and of obviating states of general debility; and, let me add, that gallic acid, which is in itself highly astringent, does not possess the property of affecting gelatine.

89. Astringents, when internally administered, would appear to moderate the morbidly increased secretions of distant parts, and to restrain hæmorrhage, by an influence upon the *primæ*

mere contact with fresh wood, causes the latter to undergo the same change.

* See Art. Injections. Part III.

viæ,* which is extended by sympathetic action to the more remote capillaries. It is not difficult for any person, who has experienced the throbbing sensation which is produced over the whole body by the acerb taste of the sloe-juice, to conceive the possibility of such a sympathy; by an analogous operation is the *cutis anserina* (goose-skin) produced by the contact of a cold substance to a limited portion of the skin, the practical application of which, as I have already stated, (42,) is so well shown by the popular and frequently successful practice of thrusting a cold key down the back to stop a bleeding from the nose, or by the known effect of cold, applied to the feet and legs, arresting the menstrual discharge.

90. As the primary operation of astringents, by actual contact, must be much more evident and powerful than that which can result from sympathetic action, we find that their efficacy is principally displayed when applied locally; thus, in that relaxed state of the capillary vessels which occurs after inflammation of the mucous membrane of the eye, astringent lotions act as charms; and there can be no doubt, as Andral has suggested, that, after a gorged state of the alimentary capillaries from irritation, a passive state of dilatation may continue, after the source of irritation has been removed, and that under such circumstances a stimulant or astringent may force the vessels to resume their natural dimensions, and get rid of the blood that constantly tends to dilate them. The decided advantage which has followed the exhibition of the preparations of steel, in certain chronic derangements of the alimentary canal, may probably be thus explained.

91. As the morbid excess of different evacuations may arise from various and opposite states of the living system, the most contrary remedies may assume the character of an astringent.

* When tannin is present in grasses, as Sir H. Davy found in that of *after-math crops*, it is voided in the excrement by animals who feed upon it, together with the bitter extractive, saline matter, and woody fibre. (Elem. of Agricult. Chem. Appendix, p. 61.) We may therefore infer, by analogy, that it does not enter the circulation.

Narcotics, at the head of which stands opium, will frequently thus act, by diminishing the irritability, upon which the increased discharges may depend; the salts of *lead*, and *cold*, fall under the same category. In diarrhœa, an astringent properly so called diminishes the flow of those acrid fluids into the intestines, by which their peristaltic motions are preternaturally increased, and it consequently represses the diarrhœa; a narcotic, under similar circumstances, might not repress the flow of the acrid matter to which I have alluded, but it would render the bowels less susceptible of its stimulus, and would therefore produce the same apparent alleviation, although by a very different operation. There is yet a third species of remedy, which may operate in restraining a diarrhœa of this description; not by stopping the flow of acrid matter, nor by diminishing the irritability of the intestinal organs, as in the instances above recited, but simply by acting *chemically* or *mechanically* upon the offending matter, so as to disarm it of its acrid qualities; such, for instance, is the nature of *absorbent*, *testaceous*, and *demulcent** medicines. Purgatives may sometimes cure a diarrhœa, by merely removing the morbid matter, the presence of which not only keeps up an irritation, but assimilates healthy fluids to its own morbid character.

92. One of the most important applications of an astringent is for the purpose of arresting hæmorrhage, when it is termed a STYPTIC. Although the pathology of hæmorrhage does not fall within the scope of the present work,† the manner in which an astringent may act in repressing the discharge can scarcely be explained, nor can a sound judgment, as to its applicability in particular cases, be formed, without a reference to a few general facts connected with its causes. Bichat has fully con-

* Rice has been generally regarded as astringent, but no such principle has ever been detected in its composition. It no doubt owes its virtue in restraining diarrhœa to a demulcent property, by which it defends the intestinal surfaces from the irritation of acrimonious fluids.

† The practitioner will find the best summary of this subject in a chapter entitled "HÆMORRHAGE," in the second volume of the Cyclopædia of Practical Medicine, by Dr. Watson.

firmed the opinion of Morgagni that, with some exceptions, *internal* bleeding does not arise from the rupture of vessels, but from a certain condition of the minute capillaries which allows the escape of blood, by a species of exhalation; now it is necessary to know, that this condition may depend upon very different and even opposite causes, that it may equally arise from congestion and relaxation, and hence pathologists have very wisely distinguished between "*active*" or "*entonic*," and "*passive*" or "*atonic*" hæmorrhage. It is therefore evident that, in the former case, astringents will not only prove useless, but positively injurious; while in the latter, for reasons already given, (89,) their exhibition may be safe and highly serviceable. The most efficient, perhaps, of all astringent medicines is the *Acetate of Lead*, which probably acts as a sedative upon the nerves supplying the vessels of the part. *Cold* is also indebted for its power to a similar agency; in the application of this remedy, however, we must remember that, if it be not continued for some time, a re-action will take place, which will increase the evil it was intended to counteract. Although it will necessarily be more efficacious when brought into immediate contact with the bleeding surface, as when ice is given in hematemesis, or cold water injected into the rectum, or into the vagina; still, upon the principle of sympathetic agency, its influence will extend beyond the part to which it is applied.*

* Various combinations, into which different metallic salts have generally entered as ingredients, have at different periods been extolled for their efficacy as *styptics*: Helvetius published an account of a preparation composed of the filings of iron and tartar, mixed to a proper consistence with French brandy, and it was long used in France, Germany, and Holland, under the name of Helvetius's styptic.

Eaton's styptic.—After the styptic of Helvetius had been discarded from the continent, it was brought into this country, and for a long time continued to be employed with confidence, under the new title of Eaton's styptic. It is now made in several different modes, and consists chiefly of an alcoholic solution of *sulphate of iron*, with some unimportant additions.

Ruspini's styptic.—Dr. A. T. Thomson states that he has discovered

93. The external hæmorrhage, which falls under the province of the surgeon, arising from the rupture of a large vessel, situated within the reach of the finger, is readily arrested by a ligature; but there are occasions, as, for instance, after an operation, where bleeding takes place from numerous small vessels, which compression will fail to arrest. Styptics, in such a case, are the only resources; and here it is that the application of ice proves so truly valuable; should this fail, but little can be expected from the gallic acid preparations; more reliance may be placed upon such local agents as favour the blood's coagulation; oil of turpentine is supposed so to act, and at the same time to stimulate the passive vessels to contraction. The contact of heated metal will frequently arrest the flow of blood, by inducing coagulation. There are also certain mechanical remedies which act by retarding the flow of blood, and in that way accelerating its coagulation; such as cobweb, charcoal in a state of impalpable powder,* &c.

94. In many cases of protracted hæmorrhage, the tone of the vessels is destroyed, and their contraction thereby prevented; in which case, opium and stimulants may be required. Sir Gilbert Blane observes, that "it is well ascertained by

this to be little more than a solution of *Gallic acid* in alcohol diluted with rose-water. A simple solution of Gallic acid, he says, is equally effective.

Acqua Brocchiari.—This supposed styptic has made much noise in Paris, and is said to be even capable of arresting the flow of blood from a divided carotid artery! The method of applying it is to saturate tow with the liquid, and slightly press it upon the bleeding vessel, where it is to remain for fifteen or twenty minutes; the rapidity with which a coagulum is said to form, and the tenacity of it, is asserted to be most extraordinary. In order to ascertain the fact, having procured a supply of it from Paris, through the kindness of my friend Dr. Badham, I proceeded to the Veterinary College, and, with the assistance of the professional gentlemen of that establishment, I made a very careful experiment upon an ass, without the least effect. In examining its composition, I found nothing but water perfumed by some vegetable essence.

* Dr. Odier informs us, that the celebrated powder of Faynard, for stopping hæmorrhage, was nothing more than the charcoal of beech-wood, finely powdered.

surgeons, whose duty it has been to attend to recent wounds in battles by sea or land, that the most successful method of saving life, endangered by profuse hæmorrhage, is by the free use of brandy or laudanum, or by both."

95. In conclusion, it may be stated, that hæmorrhage, whether internal and spontaneous, or the effect of the division of vessels during an operation, may be aggravated by a morbid and attenuated state of the blood itself; but the consideration of this question would carry us far beyond the boundary by which we are limited.

LOCAL (OR SPECIAL) STIMULANTS.

96. This second great division comprehends those medicinal agents which have been frequently classed under the head of Evacuants; for, as they stimulate particular organs, so do they occasion an increased secretion, or evacuation from them.

97. The terms *general* and *local*, as here applied, are certainly open to objection. The primary action of every stimulant must affect some one part of the system; brandy stimulates the stomach, narcotics the brain, and so on. The term general must therefore be received conventionally, as expressing an influence displayed generally over the body, without any exclusive effect on one particular structure, although it is not denied that such influence is imparted through a particular channel. The term *local* is no less objectionable, since it has different significations; in some cases it is used to denote an action which occurs only in the part to which the agent is applied; in others, to express an effect which is supposed to be confined to one particular organ, although remote from the seat of application. It is in this latter sense that the term is to be received upon the present occasion, although that of *special*, as applied to this order of stimulants, would be less exceptionable.

EMETICS.

98. Substances which excite vomiting, independent of any effect arising from the stimulus of quantity, or from that occasioned by any nauseous taste or flavour.

99. The term *local*, as here applied, might perhaps be supposed capable of bearing either of the acceptations above assigned to it; since the medicine may be said to act on the part to which it is applied, at the same time that it affects a particular organ. It must, however, be observed, that several of the emetics act even more promptly when injected into a vein, (23,) than when brought into actual contact with the nerves of the stomach.

100. Before we can determine the *modus operandi* of emetics, it will be necessary to consider the phenomena and pathology of vomiting. It is an important fact that any extraordinary stimulus applied to the nerves of the stomach, instead of increasing its direct peristaltic motions, actually inverts them; the wisdom of such a peculiar provision is manifest; it is intended to prevent the protrusion of food into the duodenum before it has undergone those necessary changes in the stomach, by which it is prepared for the more elaborate process of chylification. The act of vomiting, however, is not effected, as Dr. Haygarth formerly supposed, by the sole influence of the stomach; the brain is an important accessary: Dr. Majendie goes so far as to attribute the operation of vomiting, exclusively, to the agency of this latter organ upon the abdominal muscles, and regards the stomach as a mere passive instrument in the act;* this doctrine was supported in

* This theory, however, did not originate with Dr. Majendie, for Chiarac, a French physician of the seventeenth century, drew the same conclusion from an experimental inquiry (Histoire de l'Académie Royale des Sciences, p. 12. An. 1700.) Bayle, Lenac, and John Hunter, also advanced the same opinion, but Haller opposed it.

an elaborate experimental memoir, presented by this indefatigable physiologist to the Royal Institute of France in the year 1812; in consequence of which a committee of inquiry was appointed by the Academy, the result of which was, that without external pressure on the stomach, vomiting could not take place, but that this pressure need only be very slight; for that after the abdominal muscles had been divided, and the diaphragm paralysed, fluid could be pressed from the stomach into the œsophagus by the inferior ribs being drawn down upon the epigastric region.

101. Although we shall not be disposed to receive this theory of Majendie in its full extent, yet we cannot hesitate to admit that the influence of the nervous system is indispensably necessary for producing vomiting; and we accordingly find that this act will not take place, however forcibly the stomach may be goaded by emetics, where the energy of the nervous system is suspended, as in cases of profound intoxication, or in violent wounds and contusions of the head; while, if the brain be only partially influenced, as by incipient intoxication, or by a less violent blow upon the head, its irritability is increased instead of being paralysed, and vomiting under such circumstances is excited by the slightest causes: the fact of such opposite results being produced by the same impulse in different degrees of intensity, is no less curious than instructive. The late Dr. Richard Harrison, in his Gulstonian Lecture before the College of Physicians, treated the subject of vomiting with much ingenuity. He observed, that although the experiments of Majendie sufficiently testify the importance of the pressure of the abdominal muscles upon the stomach in the act of vomiting, and which can only be explained by the influence of the brain and nervous system, yet that he has attributed too much to their agency. "It appears to me," continued he, "that vomiting may be explained in the following manner:—*the irritation of the stomach makes a call upon the brain for the aid of the diaphragm and the abdominal muscles, in order to expel its contents; the diaphragm then becomes contracted and fixed,*

the ribs drawn down, and the abdominal muscles drawn inwards, so that the stomach is pressed on all sides by voluntary muscles, which, together WITH ITS OWN CONTRACTION, *expel the contents.*" Now, it must be obvious that where the brain, from oppression or injury, is unable to transmit its influence to these muscles,* and disregards the call of the stomach, vomiting can only be excited with difficulty, or it will be prevented altogether. As to the particular nerves through which this influence is propagated, it is a question of little practical importance.

Under such circumstances venesection may in some cases prove a powerful adjuvant, by unloading the vessels of the brain, and thus restoring to the nervous system its necessary excitability; where its powers have been paralysed by the operation of a narcotic, a copious draught of some vegetable acid, or the affusion of cold water upon the surface of the body, may impart efficiency to an emetic. The operation of *Nightshade* and some other narcotic poisons may be adduced in farther illustration of this subject: an excessive dose of the *Atropa Belladonna* produces symptoms of alarming stupor, and so difficult is it to evacuate the stomach under such circumstances, that as much as fourteen grains of the *Potassio-tartrate of Antimony* have been administered without effect; now if in such a case a copious draught of some vegetable acid be given, the emetic will be more likely to succeed. Here then we perceive that the brain, being paralysed by a narcotic poison, is unable to lend its aid to the muscles requisite for the operation of vomiting, until its energies are restored by the anti-narcotic powers of a vegetable acid. The practical precaution which

* Upon the very same principle a person may die from suffocation, in consequence of an injury in the brain; the respiratory muscles being unable to sustain the function of breathing, for want of a due supply of nervous influence. This happens in cases of apoplexy, and in poisoning by narcotics.

Those who wish for farther information upon this subject may consult the chapter on "THE PHYSIOLOGICAL CAUSES AND PHŒNOMENA OF SUDDEN DEATH," in my work on "MEDICAL JURISPRUDENCE," vol. ii. p. 16.

this view of the subject affords, is extremely important,—*not to allow the apparently inactive state of the stomach to induce us, inconsiderately, to augment the dose of an emetic:* for although the stomach, for the reasons just stated, may be unable to void its contents by vomiting, it may nevertheless retain its sensibility, and be therefore liable to inflammation. Dr. Harrison has reported a case of this kind, where the practitioner, in attempting to excite emesis in an epileptic patient, by a very large dose of *sulphate of zinc*, produced an inflammation in the viscus that terminated fatally.*

102. Vomiting may also be produced by the *primary* operation of certain agents upon the brain, by which its energy is disturbed, as by narcotics, or by the motions of swinging, whirling, and sailing: in such cases the series of actions necessary for the establishing of vomiting, commences in the brain, and is propagated by nervous sympathy to the stomach.

Dr. Marshall Hall has lately offered us a new view respecting the mechanism of vomiting: he considers that during the act the larynx is closed, the diaphragm and its various apertures relaxed, while all the muscles of *expiration* are called into action, and yet actual expiration is prevented by the closure of the larynx; the consequence of which is, that the spasmodic effort expends all its force upon the stomach, and since the cardiac orifice remains open, in consequence of the relaxed condition of the diaphragm, vomiting takes place. Whatever theory we adopt, the fact of the necessity of nervous influence remains undisputed, and this, after all, is the point of importance in a therapeutical view of the subject.

103. When an emetic is taken into the stomach, an interval of twenty minutes, or longer, usually passes without any apparent effect, a fact which certainly favours the idea of absorption; although it may also be immediately induced by mechanical irritation of the pharynx, stomach, or intestines, which

* In the case of poisoning by laudanum, related by Mr. Stanley, in the *Trans. Coll. of Phys.* vol. vi. p. 414, the inflammatory appearance of the stomach was to be attributed to the emetic given, but not acting.

proves that it is effected through the medium of the nerves. An uneasy sensation, which we term nausea, is then felt, and this continues to increase until vomiting begins. Here then we perceive are two distinct stages, each of which is marked by its own proper symptoms; the relative intensity and duration of which will be found to vary according to the nature of the exciting causes; thus some Emetics, as *Sulphate of Zinc*, act without occasioning much nausea, while others, as *Tobacco*, excite it to a degree which is far greater than is proportioned to their emetic power: this is a fact of great importance in directing us in the selection of an emetic, for we shall find that in some diseases it is a great object to avoid that state of system which invariably accompanies nausea, while in others it affords the best mode of answering an important indication of cure.

104. Nausea would seem to depend upon the exertions of the stomach and muscles, not being proportioned to the efforts of the brain, in order to produce vomiting; and hence arises the use of copious dilution to distend the stomach, so that it may resist the spasm of the abdominal muscles, and prevent the necessity of their extreme and painful contraction.* Where this balance, however, is maintained, as during the operation of an ordinary emetic, the following are the symptoms which characterise the two stages; while the nausea only is present, the countenance is pale and shrunken, the pulse feeble, quick, and irregular, and there is a feeling of cold; but as soon as vomiting commences, the face becomes flushed, the pulse quicker and stronger, although it seldom returns to its natural standard, until some time after the vomiting has ceased. A degree of languor, a disposition to sleep, and a general moisture upon the skin, are the circumstances which occur after the total cessation of the paroxysm.

105. The feeble state of the circulation, as indicated by the

* Animals are observed instinctively to swallow air previous to vomiting, which acts like the draughts of liquid. M. Majendie also states, that in some of his experiments during the state of nausea which preceded vomiting, air was drawn into the stomach.

pulse, and the general coldness and languor experienced during a paroxysm of nausea, are to be ascribed to those sympathetic relations by which the brain, stomach, and heart are reciprocally influenced.

106. The advantages to be obtained from the administration of an emetic in the cure of disease, may either depend upon its *primary* or *secondary* operation, that is to say, upon the mere evacuation of the stomach, or upon those changes which occur in distant parts from sympathy; thus *Hernia Humoralis*, swelled testicle, &c., have been cured, and John Hunter says he has seen a bubo dispersed by an emetic. The judicious practitioner, in the selection of an emetic, will always be guided by the nature of the indication which he intends to fulfil. If his object be to evacuate the stomach quickly and completely, he will avoid those emetics that are distinguished by their nauseating tendency, as in cases of disease which depend on a disordered state of stomach, connected with undue distension, and the presence of acrid and indigestible matter. If, on the other hand, his intention be to influence some remote organ through the sympathetic powers of the stomach, an emetic of an opposite tendency may be better calculated to answer such indications. In some cases he is to seek a beneficial result from the mechanical action of the diaphragm and abdominal muscles, by whose pressure the gall-bladder and hepatic ducts are emptied of their contents; and hence jaundice, arising from the obstruction of biliary calculi, has been suddenly removed by the *concussion* of an emetic: a similar pressure upon the thoracic viscera may occasion expectoration, and relieve the bronchial vessels in cases of asthma, catarrh, and croup.

107. Vomiting, when produced by the operation of a mild emetic, does not appear to exhaust the excitability of the stomach, but, on the contrary, to increase its tone, for we generally find the process of digestion is carried on more vigorously afterwards; although it is probable that, by frequent repetition, a different result would be obtained, and we should find that its motion would become liable to inversion by slight

stimuli; we may therefore question the propriety of that practice which is so strenuously recommended by Hippocrates,* and other ancient physicians, to administer emetics frequently to those in health, in order to prevent the incursions of disease.

108. The benefits arising from the secondary effects of an emetic are numerous and extensive. It has been observed that during nausea the force of the circulation is considerably abated, hence the use of these remedies in hæmorrhage. The value of ipecacuanha in doses of a scruple given in the evening, has lately been established by Dr. Osborne, of Dublin, in cases of Menorrhagia; he administers on the following morning an acidulated saline purge, and he says that by such means the discharge has ceased in twenty-four hours. The *Potassio-Tartrate of Antimony* is not equally efficacious. And, as the energy of absorption is generally in an inverse ratio to that of the circulation,† we frequently obtain from a nauseating

* Hippocrat. de Diæta, Lib. iii. et alibi passim.

This predilection of the ancients for emetics is the more extraordinary, as they were acquainted with those only which were of the most violent and unmanageable description; the veratrum, or white hellebore, was sometimes fatal.

† Few discoveries in physiology have thrown greater light upon this important subject than that of M. Majendie, published in his JOURNAL DE PHYSIOLOGIE EXPERIMENTALE, (1er numero—Janvier, 1821,) in a paper entitled "Memoire sur le Méchanisme de l'Absorption." The results contained in this essay are the more interesting to me, as they were read at the Academy of Sciences at Paris some time after the publication of the third edition of my PHARMACOLOGIA, and it will be observed in what a satisfactory manner they confirm the views which I offered at that time, respecting the influence of venesection in accelerating the absorption of mercury. In the fourth edition, (published in October, 1820, p. 116,) these views were farther extended; and as I could not have been influenced by the experiments of M. Majendie, which were not published until some time afterwards, it is very fair to conclude, that when two persons arrive at the same result by different trains of investigation, such a result must be correct. The conclusions established by the experimental inquiries of M. Majendie, with regard to absorption, appear to me to be so important, in reference to the object of the present work, that I

dose of an emetic, considerable assistance in the treatment of anasarca, and other dropsical swellings. Emetics have also the effect of removing congestion in the capillaries. Those medicines that are liable to produce at once full vomiting, without any previous stage of nausea, are of course less calculated to fulfil such indications. In the same manner we should select a *nauseating* emetic, when our object is to promote the passage of a gall-stone through the *ductus communis*, for the nausea so excited will relax the duct, while the mechanical concussion tends to push the obstructing matter forward. On the other hand, whenever our object is to evacuate the stomach,

shall pause, in this place, for the purpose of furnishing the reader with a short account of them. M. Majendie states, that while performing the experiment of injecting warm water into the veins of a living animal, he first conceived the idea of observing what effects would be produced upon the function of absorption by the artificial plethora thus occasioned. Having accordingly injected a quantity of water into the venous system of a middle-sized dog, he introduced a small portion of an active substance, whose effects were well known, into his side, when he was surprised to find that its usual operation was not manifested until after an interval much longer than usual: the same experiment was afterwards repeated upon another animal, and with similar results. In a third experiment, as much water (about two pounds) was injected as the animal could sustain without destruction, in which case the poisonous substance produced no effect whatever, the powers of absorption appearing to be entirely suspended; and having waited during half an hour for the occurrence of those symptoms which, under ordinary circumstances, would have manifested themselves in two minutes, M. Majendie concluded that if vascular congestion be the cause of the suspension of absorption, the function ought to be restored by the removal of this artificial condition,—an opinion which he proceeded to verify by experiment. The jugular vein of the animal under trial was accordingly opened; and the ingenious operator had the satisfaction to observe the effects of the poison gradually developing themselves in proportion as the blood flowed. M. Majendie next proceeded to confirm the truth of his position, by an experiment, the converse of those above related. An animal was bled, to the amount of about half a pound, and the poisonous substance applied to the pleura of the animal, as in the foregoing experiments, when it appeared that those effects which, under ordinary circumstances, were not evident until after a period of twelve minutes, manifested themselves after an interval of only thirty seconds.

and to prevent absorption, we must take care to cut short the nauseating stage; a precaution which is highly important in the treatment of a case of poisoning. The state of the stomach produced by vomiting is very frequently extended, by sympathy, to the vessels of the skin, in consequence of which a diaphoresis not unusually follows the operation. In the different varieties of febrile disease, this circumstance stamps additional value upon the class of emetics; while at the same time that they eject any offensive matter which may be present in the stomach, they thus control the accelerated circulation.

109. From the violent muscular exertions which take place in the act of vomiting, the administration of an emetic may be very injurious in certain states of the body. In consequence of the pressure applied to the descending aorta, and the interrupted circulation through the lungs, from impeded respiration, the blood returns with difficulty from the head during a paroxysm of vomiting; and in plethoric states of the body, or in cases of determination of blood to the cerebral or pulmonary organs, the act of vomiting cannot be considered as free from danger. The concussion of an emetic may also produce mischief in the advanced stage of pregnancy, and in *hernia* and *prolapsus uteri;* while in extreme debility there is the danger of a syncope being produced, from which the patient may never recover, as I once witnessed in the last stage of phthisis, where an emetic was imprudently given, with the intention of dislodging the pus with which the lungs were embarrassed. "*Refrain from vomits in phthisis,*" is an aphorism of Hippocrates. (*Sect.* iv. 8.)

110. By violent and protracted retching a person will sometimes become jaundiced; the stomach, diaphragm, and abdominal muscles are, under such repeated efforts, apt to be rendered, to an eminent degree, irritable; so that at each effort of the former to discharge its contents, the latter will frequently be thrown into strong spasmodic contractions, and the liver, together with the gall-bladder, will be suddenly caught, and, as it were, squeezed in a powerful press, in con-

sequence of which the bile will regurgitate, and be carried into the *venæ cavæ;* for Haller has shown with what facility a subtle injection, when thrown into the hepatic duct, will escape by the hepatic veins; and upon which Dr. Saunders observes, "I know this to be a fact, for I have ascertained by experiment, that water injected in the same direction will return by the veins in a full stream, though very little force be used." When a jaundice is thus produced, it will gradually disappear without the aid of any medicine; the kidneys are the principal means by which all unnecessary bodies are extracted from the circulating mass; a portion of bile will therefore, under such circumstances, be eliminated in every discharge of urine.

111. The different emetics employed in practice are derived from the vegetable and mineral kingdoms, some of which appear to produce their effects by an immediate impression upon the nerves of the stomach, while others require to be absorbed into the circulation before they display their energies. *Ipecacuanha* would seem to act primarily on the stomach, but *potassio-tartrate of antimony* has been found, by experiment, to occasion vomiting when injected into the veins of an animal; while the other mineral emetics, viz. the preparations of *copper* and *zinc*, undoubtedly operate on the stomach, and without inducing much nausea.

Emetics differ, then, from each other in the following particulars:—

1. Celerity of action.
2. Severity of effect.
3. Degree of nausea.

CATHARTICS.

112. Medicines which quicken or increase the evacuation from the intestines, or which, when given in a certain dose, occasion purging.

113. These remedies, from a general difference in their modes of operation, have been classed under two divisions—LAXATIVES and PURGATIVES. The former operate so mildly that they merely evacuate the contents of the intestines, without occasioning any general excitement in the body, or even stimulating the exhalant vessels of the canal: the latter produce a considerable influx of fluids from these vessels, and extend their stimulant effect to the system in general; and where these effects are very violent, the purgative is further distinguished by the epithet DRASTIC. Laxatives, then, may be said to empty the bowels simply, and to carry off extraneous matter, which is out of the course of the circulation; but purgatives, as they occasion a constitutional effect, may be made subservient to very important purposes.

114. The effects of a purgative may depend upon three different modes of operation, viz.

1. *By stimulating the muscular fibres of the intestines, whence their peristaltic motion is augmented, and the contents of the bowels more quickly and completely discharged.*

2. *By stimulating the exhalant vessels, terminating in the inner coat of the intestines, and the mouths of the excretory ducts of the mucous glands; by which an increased flow of serous fluids takes place from the former, and a more copious discharge of mucus from the latter; the effect of which is to render the fæcal matter thinner and more abundant.*

3. *By stimulating the neighbouring viscera, as the liver and pancreas, so as to produce a more copious flow of their secretions into the intestines.*

115. It appears that different purgatives have very different powers in relation to the several modes of operation above specified; some medicines, for example, urge the bowels to evacuate their contents by an imperceptible action upon the muscular fibres, and little or no increase of serous discharge attends the evacuation; such are *manna*, *sulphur*, and *magnesia:* there would seem, moreover, to be certain bodies that have the property of increasing the peristaltic motions by operating as mechanical stimulants upon the fibre. It would not be difficult to derive many illustrations of this fact from the history of herbivorous quadrupeds, and I have been disposed to consider the harsh and coarse texture which certain grasses assume in moist situations, as a wise provision in nature to furnish an increased stimulus to the intestines of the animals who feed upon them, at a time when their diminished nutritive qualities must render such a result desirable; but the operation of a mechanical laxative may be demonstrated by a more familiar example: the addition of bran to our bread, constituting what is known by the name of *brown bread*, induces laxative effects, merely from the mechanical friction of the rough particles, or scales of the bran, upon the inner coats of the intestines, for the wheat without the bran in bread is not particularly laxative.* Other cathartics stimulate the fibres to a much greater degree, and the effects are either confined to a part of the canal, or communicated to the whole range of the intestines, from the duodenum to the extremity of the rectum; *aloes* will furnish a good example of the former, and *colocynth* may be adduced as an instance of the latter mode of operation. Other cathartics, again, direct their stimulus to the exhalant

* The practical application of this fact may be useful, and digestion, in certain cases, may be thus promoted by the simple expedient of changing the quality of our bread.

vessels, and are accordingly distinguished by the force with which they produce serous evacuations, and for which they were formerly denominated *hydragogues;* such are *saline purgatives*, and certain vegetable bodies to be hereafter described. Dr. Cullen has even supposed that some of these medicines may act solely in this way, and without increasing directly the peristaltic motion; there is, however, as Dr. Murray very justly remarks, no proof of such an hypothesis, and it seems scarcely probable that any substance should act as a stimulant on these vessels, without at the same time stimulating the mobile fibres of the intestines. *Mercurial purgatives* appear to possess, in an eminent degree, the power of exciting the functions of the liver, and thereby occasioning an influx of bile into the intestines. From the indications which cathartics are capable of fulfilling, their utility in many diseases must be apparent; the extent of their importance and value was, however, never justly appreciated until the valuable publication of Dr. Hamilton on this subject, in which the author has pointed out, with more precision than any preceding writers had done, the therapeutic principles which should regulate their administration. His practice has clearly proved that a state of bowels may exist in many diseases, giving rise to a retention of feculent matter, which will not be obviated by the occasional administration of a purgative, but which requires a continuation of the alvine stimulant, until the healthy action of the bowels is re-established. Since this view of the subject has been adopted, numerous diseases have received alleviation from the use of purgatives that were formerly treated with a different class of remedies, and which were not supposed to have any connexion with the state of the alvine evacuations; thus in fever, the peristaltic motion of the intestines is diminished, and their feculent contents are unduly retained, and, perhaps, in part absorbed, becoming of course a source of morbid irritation. This fact has been long understood, and the practice of administering cathartic medicines under such circumstances has been very generally adopted; but until the

publication of Dr. Hamilton, physicians were not aware of the necessity of carrying the plan to an extent beyond that of merely emptying the *primæ viæ*, and they did not continue the free use of these remedies through the whole progress of the disease.

116. Cathartics are essentially serviceable also in several diseases of the class NEUROSES, which are generally intimately connected with a morbid condition of the alimentary passages; *chorea* and *hysteria* have been very successfully treated in this manner. The diseases incident to puberty in both sexes are also best relieved by a course of purgative medicines, and their effects in *chlorosis* have conferred upon many of them the specific title of EMMENAGOGUES.

117. But the therapeutical utility of Cathartics extends beyond the mere feculent evacuations which they may occasion. In consequence of the stimulating action which some of them exert upon the exhalant vessels, they abstract a considerable portion of fluid from the general current of the circulation, and are, on that account, beneficial as *Anti-phlogistics*. For the same reason they may act as powerful promoters of absorption, for there exists an established relation between the powers of exhalation and absorption, so that when the action of one is increased, that of the other is augmented.

118. Certain purgatives, as I have just stated, exert their influence upon the neighbouring organs, and are calculated not only to remove alvine *sordes*, but to detach and eliminate foul congestions from the biliary ducts and pores.

119. With such facts before us, it is impossible to concede to the opinion of Dr. Hamilton,* that the different species of purgative medicines *do not possess distinct powers over the different species of matter to be evacuated;* on the contrary, there is reason for reviving the ancient theory, too inconsiderately abandoned, and which acknowledged these different distinctions

* Since the publication of this opinion, in the 5th edition of the Pharmacologia, Dr. Hamilton has honoured me by a letter on the subject, but I am still bound to confess that my sentiments remain unaltered.

in the operations of cathartic medicines, under the appropriate names of *Hydragogues*, *Chologogues*, &c.

120. The importance of cathartic medicines having been shown, and the distinctions in their modes of operation established, it only remains to say a few words upon the subject of their abuse. All the remedies of this class, but more especially those of considerable power, require caution in their administration, even in those diseases where they are indicated by peculiar symptoms, especially if there be any tendency to inflammation, or to extreme debility, although this latter symptom is often rather apparent than real, and is at once removed by the brisk operation upon the bowels; during pregnancy and immediately after delivery, and during the flow of the menses, the prudent practitioner will use a discretionary caution in their exhibition. The too frequent use of these medicines will induce marasmus, and render the bowels so morbidly irritable, that purging is easily excited by the ordinary stimulus of our aliments; while in some habits the contrary obtains, and the resource to which the valetudinarian flies for relief only increases the torpor of the intestines, and confirms his costiveness.

The mode of adapting, combining, and administering Cathartics, will present subjects for our future consideration.

121. If it be advantageous in many cases to quicken and increase the action of the intestines, so is it equally important in particular conditions of the system, to retard and diminish it; this, however, is a point of practice to which the physician has not hitherto directed sufficient attention. If there be a circumstance in the treatment of disease which, above every other, is left to the government of a blind routine, it is the management of the bowels; let the complaint be what it may, the temperament, strength, or circumstances of the patient be ever so different, the first question of the practitioner relates to the bowels—and, should they not have acted during the previous twenty-four hours, away he flies to the aid of aloes, colocynth, senna, calomel, &c. &c., to force the reluctant canal to pour

forth its contents. Did it never occur to the pathologist that nature may, upon some occasions, wisely retard that operation which he is so anxious to provoke?—May not the alimentary organs, in certain states of weakness, require time for the due performance of their functions? I can confidently answer this question in the affirmative, not from any reliance upon a favourite theory, but from a conviction forced upon me by practical experience. I am perfectly convinced that cases of marasmus that might have been cured had nature been left to her own operations, have been brought to a fatal termination by the officiousness of the practitioner, and by the unrelenting use of purgatives, sweeping away from the *primæ viæ* the elements of nutrition before nature had time to combine and absorb them.

In conclusion, it is only necessary to observe that a constant inspection of the alvine discharges is indispensable during a course of purgatives; without which, says Dr. Barlow, "it is impossible to form an accurate judgment either of the propriety of purging, the selection of purgatives specially indicated, the extent to which their operation should be carried, or the period for which their use should be continued." (*Cyclop. of Prac. Med., Art. Plethora.*)

EMMENAGOGUES.

122. Medicines which are capable of producing the Menstrual discharge.

123. As Amenorrhœa, or retention of the menses, is generally the effect of a morbid state of the body, it follows that remedies capable of acting as Emmenagogues can only be *relative* agents, unless indeed we are disposed to accede to the opinion so generally maintained in the writings of the older

physicians, but now generally discarded, *that certain substances exert a specific* action upon the uterus.* No one can deny that there are many substances which, when received into the stomach, have their stimulant operation more particularly determined to one part than to another; alkalies, for example, to the kidneys; cantharides to the bladder; mercury to the salivary glands, &c. (23.) Reasoning therefore by analogy, it was not unphilosophical to conclude, that similar medicines might exist with respect to the uterus; but experience has not confirmed the supposition, there being no proof of any of the substances styled *emmenagogues* producing their effects by any *specific* influence upon the uterine system. And let it be remembered that, as the uterus is not an organ intended for the elimination of foreign matter, it is necessarily less under the direct control of medicines. If the term *emmenagogue* be assumed conventionally, according to this view of the subject it may be retained without any fear of error, otherwise it would be wiser to remove the name from our classification.

124. The suppression of the catamenia usually depends upon a debilitated state of the body, although it is sometimes the consequence of a plethoric diathesis; in the former case, tonics, in the latter venesection, may display the powers of an emmenagogue; upon which occasion I have frequently derived the greatest benefit by cupping the patient upon the loins.

* The melampodium, or black hellebore, was recommended as an agent of this description in the strongest terms, by Mead. Savin (juniperus sabina) is another vegetable which has been generally considered as a specific emmenagogue. With some authors the rubia tinctorum, madder, with others the sinapis alba, have been regarded as remedies of this nature; and lately polygala senega has been extolled by the American practitioners; in modern times, however, few substances have been more confidently recommended as uterine stimulants than the secale cornutum, or ergot, but of which I have no practical knowledge. Dr. Locock says he has employed it with success in doses of ten grains three times a day. (*Encyc. Med.*) Dr. Coindet, of Geneva, considers iodine the most certain and powerful emmenagogue we possess, and even attributes its success in bronchocele to the sympathy which the uterus and the thyroid gland manifest for each other.

Where the disease occurs in young women, about the age of puberty, it is very generally connected with extreme debility of the system; the preparations of iron, bark, and other invigorating medicines are accordingly the most likely to succeed in its cure. Whereas in full florid habits, when the catamenia are suddenly suppressed, *laxatives*, *diaphoretics*, or *blood-letting* afford the surest means of relief.

125. There are two other classes of medicines which may occasionally prove emmenagogue—ACRID PURGATIVES, which act upon the rectum, and hence by *contiguous sympathy* upon the uterus, as *aloes*, &c., and STIMULATING DIURETICS, as *cantharides*, the *turpentines*, &c., which are supposed to excite the womb sympathetically, by their stimulus upon the bladder. Dr. Locock states that he has found a combination of myrrh, aloes, sulphate of iron, and the essential oil of savine, of great utility. (*Encyclop. of Med.*) Nor is the advantageous influence of mercury to be overlooked, which, in cases of morbid action in the secreting functions, proves a Herculean remedy.

DIURETICS.

126. Medicines which increase the urinary discharge.

This effect is produced by very different modes of operation; and as some of them are mutually incompatible with each other, it is essential that we should understand the *modus operandi* of each individual of which the class consists, in order that we may direct its application with precision.

127. There is undoubtedly no tribe of medicinal agents more precarious in their nature and effects than that of Diuretics; this fact in a great measure depends upon the uncontrollable character of the organs upon which they act, but it must at the same time be admitted, that their failure frequently depends

upon their modes of operation being directly incompatible with the state of the system at the time of their administration.

128. The following classification may perhaps serve to bring together the principal facts which are known upon the subject, and at the same time to display them in an order which is calculated to demonstrate their practical bearings and relations. It was first promulgated in the third edition of the present work, and has been since adopted by many of the Pharmacological writers.

DIURETICS,

ARRANGED ACCORDING TO THEIR SUPPOSED MODES OF OPERATION.

CL. I.—MEDICINES WHICH ACT *PRIMARILY* ON THE URINARY ORGANS.

1. *By stimulating the secreting vessels of the kidneys,* BY CONTACT.

a The medicines not undergoing any decomposition *in transitu.*

1. *Potassæ.*
2. *Potassæ Nitras.*
3. *Oleum Terebinthinæ.*
4. *Juniperus Communis.*
5. *Cantharides.*
6. *Potassæ Hydriodas.*

b The medicines undergoing decomposition *in transitu.*

1. *Potassæ Acetas.*
2. *Potassæ Bi-tartras.*
3. *Scilla Maritima.*
4. *Colchicum Autumnale.*
5. *Copaifera Langsdorfii.*
6. *Cytisus Scoparius.*

CL. II.—MEDICINES WHICH ACT *PRIMARILY* ON THE ABSORBENTS, AND *SECONDARILY* ON THE KIDNEYS.

Mercury.

CL. III.—MEDICINES WHICH ACT *PRIMARILY* ON THE STOMACH AND PRIMÆ VIÆ, AND *SECONDARILY* ON THE ABSORBENTS.

1. *By diminishing arterial action, and increasing that of absorption.*
   1. *Digitalis.* 2. *Nicotiana Tabacum.*
2. *By increasing the tone of the body in general, and that of the absorbent system in particular.*
   Bitter Tonics, &c &c.
3. *By producing catharsis, and thereby increasing the action of the exhalants* directly, *and that of the absorbents* indirectly.
   1. *Elaterium.* 2. *Jalap, &c. &c.*

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129. I. Of Medicines which act primarily on the Urinary Organs.

1. *By stimulating the secreting vessels of the kidneys, by actual contact.*

a The substance not undergoing any decomposition *in transitu.*

130. It is easy to imagine that any substance which is capable of entering the current of the circulation, and of stimulating the kidneys by a direct application to their secerning vessels, may occasion a more copious urinary discharge; in this manner the different saline* preparations, *Potass*, *Soda*, *Nitrate of Potass*, &c., are brought to the kidneys in the course of the

* Saline bodies would appear to be the peculiar stimuli of these organs, the principal use of which is to separate such saline matter from the blood as would otherwise accumulate in the system. That these saline diuretics actually pass off by the kidneys may be satisfactorily shown by an examination of the urine, in which the bodies in question may be chemically detected. Let any person swallow several doses of nitre, taking care that the bowels are not disturbed by the medicine, and he will find, by dipping some paper into his urine, and afterwards drying it, that it will deflagrate, and indicate the presence of nitre.

circulation, and exciting the vessels to an increased action, promote the secretion of a larger proportion of watery fluid from the blood, in consequence of which the absorbents are indirectly stimulated in order to supply the deficiency, and in this manner dropsical swellings are reduced.

131. Water, as a simple diluent, will promote the action of the kidneys, and it is very judiciously remarked by Dr. Cullen, that by withholding the use of fluids in dropsy, you will diminish the quantity of fluids secreted, and allow the secretories of the kidneys to fall into a state of inactivity and collapse. This is a sufficient answer to those who defend the practice of enjoining an abstinence of all drinks in dropsy.

b *The diuretic remedy undergoing decomposition* IN TRANSITU.

132. The digestive organs appear to possess the power of readily decomposing all saline compounds into which *vegetable* acids enter as ingredients, and of eliminating their alkaline base, which, being in the course of the circulation, carried to the kidneys, excites them into action, and promotes the excretion of urine; and it is probably in this way that the *Acetate*, *Citrate*, *Bi-tartrate*, and other analogous combinations of *Potass* and *Soda* prove diuretic (35): on the other hand it is equally evident, that salts containing the *mineral* acids are not under the control of the decomposing powers of the *chylopoietic* organs, and consequently do not undergo any changes *in transitu*, although some of these salts, as I have just stated, especially the more soluble ones, are absorbed entire, and prove diuretic. *Sulphate of Potass*, from its insolubility, is not readily absorbed, and its composition will not allow the development of its base; we perceive, therefore, that it has not any tendency to produce an influence upon the urinary secretion.

133. Certain vegetable bodies likewise appear to occasion diuresis by a similar mode of operation, and it is worthy of

notice that these medicines generally contain a bitter principle, which is probably separated by the analysing powers of the stomach, as exemplified in *Scilla maritima*, *Colchicum autumnale*, *Lactuca Virosa*, *Gratiola officinalis*, *Cytisus Scoparius*, (*Cacumina,*)*Juniperus communis*, *Copaifera Langsdorfii*, (*Resina Liquida,*) &c. The stimulant powers of a bitter vegetable principle upon the *primæ viæ*, have already been fully noticed under the consideration of TONICS, (83,) and it is reasonable to suppose, that an analogous principle, if introduced into the circulation, may exert a corresponding impulse upon the organs with which it comes into contact.

134. It particularly merits attention, that the diuretic operation of any body that acts by being absorbed, is at once suspended if catharsis follows its administration, whether in consequence of the largeness of its dose, its increased solubility, or from the effect of its combination with some purgative, for it is a law *that the processes of assimilation and absorption from the duodenum, are arrested, or very imperfectly performed during any alvine excitement.* The different effects of the saline compounds of the alkalies with tartaric acid, elucidate the truth of this law in a very striking manner—thus, *Bi-tartrate of Potass*, or Cream of Tartar, in well-regulated doses, acts, as we all know, upon the kidneys; the tartaric acid being, as I suppose in this case, abstracted and assimilated by the digestive process, and at the same time the alkaline base (Potass) eliminated, and subsequently carried into the circulation; but if we increase the solubility of the compound, by reducing it to the state of a neutral tartrate, (*soluble tartar,*) or by combining it with *Boracic acid*, or some body that has a similar effect; or what is equivalent to it, if we so increase the dose of the *cream of tartar*, that full catharsis follows its administration, then diuresis will not ensue, since no decomposition can take place under such circumstances, nor can it be carried by absorption into the circulation. *Nitre* and those salts which are carried to the kidneys without previous decomposition *in transitu*, are subject to the same law; for, if we combine them with pur-

gatives, their presence can no longer be recognized in the urine, as I have ascertained by experiment. *Oil of Turpentine*, in doses of two fluid-drachms, may so excite the urinary organs as to produce even bloody urine; whereas a fluid-ounce will scarcely occasion any apparent influence upon those functions, because the increased dose acts upon the bowels, and consequently prevents its passage into the circulation.

135. *Sulphate of Magnesia* does not readily produce any diuresis, because it operates upon the bowels, but the experiments of Vitet and Bracy Clarke have shown, that if this saline compound be administered to the horse, whose bowels are not easily affected by purgatives, it acts powerfully upon the kidneys; and I will take occasion in this place to observe that, on account of the in-irritability of the bowels of the horse, diuretic medicines are more certain in their operation than in the human subject; a fact which, in itself, shows the importance of attending to the state of the bowels, during a course of those diuretics which require to be absorbed before they can produce their specific effects.

136. Equally necessary is it to attend to the state of the vessels of the skin, for if during the administration of a diuretic, these vessels be excited by external warmth, its action may be diverted from the urinary organs to the exhalants on the surface, and occasion diaphoresis; but if the surface of the body be kept cool, this diversion will not occur: so greatly indeed does cooling the surface determine to the kidneys, that the usual diaphoretic medicines may, by an attention to this circumstance, be converted into powerful diuretics. There is, perhaps, no sympathy in the animal body more striking and less questionable than that which subsists between the functions of the skin and kidney.

C. II. Medicines which act *primarily* on the Absorbents, and *secondarily* on the Kidneys.

137. It has been shown, in the former division, that by

increasing the action of the kidneys, we diminish the quantity of water in the blood, and consequently occasion an extraordinary action of the absorbents to supply the deficiency, whence dropsical accumulations disappear. It remains to be stated that an operation, which may be considered the converse of the one just described, is not unfrequently established: the absorbent vessels, in this case, are first roused to extraordinary action, and the blood therefore becomes surcharged with serous matter, in consequence of which the kidneys are stimulated, and it is eliminated through the urinary passages: so that in the former case the absorbent vessels may be said to be called into action by the kidneys, while in the latter the kidneys are obviously subservient to the increased energy of the absorbent system. The preparations of Mercury, and probably of Iodine, are the only medicinal bodies which we can strictly consider as specific stimulants to the absorbent system; and of their power in directly acting upon these organs there are such ample proofs, that it is unnecessary to adduce any additional evidence upon the subject. In instances of increased absorption from the agency of other medicines, the effect must be considered as rather arising from their *secondary* than primary operations, the most important of which will constitute objects of inquiry in the succeeding divisions of the subject.

C. III. Medicines which act *primarily* on the Stomach or System, and *secondarily* on the Urinary Organs.

138. A diuretic effect is very frequently occasioned by substances which act on the stomach and *primæ viæ*, producing a peculiar state of these organs, which *sympathetically* affects the whole body, and more particularly the absorbent system, and the vessels concerned in the secretion of urine from the blood. As this primary influence upon the stomach, and the effects to which it gives rise in remote parts, are very different in their character, according to the nature of the remedy employed,

and the state of the system at the time of its administration, the present attempt to investigate and generalize these relations, and to adopt them as the basis of a classification, may ultimately lead the practitioner to some distinctions of practical utility.

1. *By diminishing Arterial Action, and increasing that of Absorption.*

139. It would appear that the action of the vessels employed in the circulation of the blood, and the energy of the absorbents, are, to a certain extent, antagonist powers. The experiments of Majendie demonstrate that the absorption of a poisonous substance is retarded by a plethoric, and accelerated by a depleted state of the sanguineous system—the fact is practically established by numerous phenomena in pathology (108). Dr. Blackall has very satisfactorily shown the connexion which subsists between increased arterial action and diminished absorption. Hence it follows that remedies capable of controlling the circulation may affect the activity of absorption, increase diuresis, and cure dropsy; in this manner the *Digitalis Purpurea* acts as a sorbefacient, and it may be remarked that it seldom or never produces its diuretic effects, without a concomitant reduction of the frequency of the pulse; its power too appears only when it is administered in dropsy; in a state of health it will reduce the pulse, but not increase the discharge of urine. Tobacco has also somewhat analogous powers in promoting absorption, and its operation is accompanied with a corresponding depression of vascular action. Venesection, upon the same principle, may occasion, in certain cases of dropsy, a discharge of the accumulated fluid.

2. *By increasing the tone of the Body in general, and that of the Absorbent System in particular.*

140. That diminished absorption, and the consequent accu-

mulation of serous fluids in the cellular texture, and different cavities, frequently depends upon general debility, is very obvious, whence fevers, whether of the intermittent or continued kind, which have been long protracted, are followed by *œdematous* swellings. In states of extreme debility, the exhalant vessels would seem, from their laxity, to permit the thinner parts of the blood to pass too readily through them: this is proved by the circumstance that palsied limbs, in which such a laxity may be presumed to exist, are frequently affected with *œdema;* and the truth of this explanation is still farther corroborated by the advantages which accrue on these occasions from the mechanical support of pressure from bandages. In such cases those remedies which are capable of renovating the vigour of the body can alone prove of any signal service. Dr. Blackall presents us with an illustrative case of this nature, on the authority of Mr. Johnson of Exeter, in which the tonic powers of well-fermented bread occasioned in the space of a few hours an effect so powerfully diuretic, as to have cured the sailors on board the Asia East Indiaman, who had been attacked with dropsy, in consequence of the use of damaged rice.

141. Thus then do Diuretics, in some cases, CURE BY EVACUATING, while in others, as in the instance above cited, they EVACUATE BY CURING.

142. A case has occurred in my own practice, which not only affords a striking illustration of the present views, but is well calculated to convey to the inexperienced practitioner a very instructive lesson of caution. A man of the age of thirty-five, of the most dissolute habits, was attacked, after a debauch of several days' continuance, with inflammatory symptoms in the chest; a very large quantity of blood was suddenly abstracted, and the bleeding was repeated after the interval of a few hours. The respiration became laborious, and I was desired to visit the patient. I found that little or no urine had been evacuated since the attack, and that there were evident symptoms of effusion, the legs were swollen, and the difficulty

of breathing was rapidly increasing. Under these circumstances I directed a large dose of *Ammonia* with some stimulating diuretics, which were to be repeated at short intervals. On the following day the distressing symptoms had subsided, a large quantity of urine had passed, and the patient expressed himself greatly relieved; unfortunately, however, in consequence of a slight increase of his distress in the evening, an injudicious friend in attendance took more blood from the arm—the dropsical effusions rapidly increased, and life was extinguished in the course of three days by confirmed Hydrothorax.

3. *By producing Catharsis, and thereby increasing the action of the Exhalants* directly, *and that of the absorbents* indirectly.

143. It has been already stated, under the consideration of Cathartics, that certain medicines of that class excite the exhalants of the alimentary canal, and occasion a very copious discharge of serous matter: by this operation the blood is deprived of a large portion of water, and the absorbents are thus indirectly stimulated to supply the deficiency; *Elaterium*, and some other *hydragogue* cathartics, may be thus employed with extraordinary success for the cure of certain forms of Dropsy, where the vital powers of the patient can sustain the violence of the remedy.—In the whole circle of medicinal operations there is nothing more wonderful than this, that an impression made on the internal surface of the *primæ viæ*, by a few particles of matter, should thus convey by magic, as it were, an impulse to the most remote extremities, rousing their absorbents to action; and, in case of *œdema* there, awaking the sleeping energies of these vessels, which, like millions of pumps at work, transmit the morbid fluid to the intestines and urinary passages, effecting a detumescence of the hydropic limbs in the course of a few hours, and thus affording a striking illustration of the sympathetic action of medicines, and an in-

structive example of the operation of those of the sorbefacient class.*

144. The observations which I have thus offered will lead the practitioner to select the particular diuretic which is best calculated to fulfil the indications of each individual case; and they will at the same time point out those which cannot be administered in combination, without a violation of the law of medicinal compatibility. With respect to the general efficacy of these medicines it may be stated, that where the disease originates from *organic* affections of the chylopoietic viscera, it will not be cured by the mere evacuation of the water by diuretics; but that where it has taken place from diminished absorption, these remedies may be reasonably expected to effect a cure.

DIAPHORETICS.

145. The term *Diaphoretic* has been applied to those medicines which increase the natural exhalation of the skin, and when they act so powerfully as to occasion sweating, they have been commonly distinguished by the name of *Sudorifics;* but as no difference exists between these remedies, but in the degree of force with which they act, we may very properly comprehend the whole under the general title of Diaphoretics: the fluid effused is also in both cases similar, but in the one it is discharged more slowly, and is carried off by the conducting†

* See Sir Gilbert Blane's *Medical Logic*, edit. 2nd, p. 190.

† The cutaneous discharge is very materially modified by the state of the atmosphere, in its relations to moisture and dryness: when the air contains much moisture it is a bad conductor of the perspirable matter, which therefore, instead of being carried off in an insensible form, is condensed upon the surface: hence we appear to perspire greatly upon

power of the air, in the insensible form of vapour, while in the other case it is so copiously effused from the exhalant vessels, as to appear in the liquid form.

146. As obstructed perspiration may depend upon very different, and even opposite states of the system, so may the most adverse medicines fall under the denomination of diaphoretic remedies.

147. In some affections, a deficient diaphoresis may be associated with increased vascular action, and in others, with a slow languid circulation.

148. Diaphoretics may be considered as operating, either by directly stimulating the cutaneous capillaries;—by increasing the general action of the vascular system;—by relaxing the morbidly constricted mouths of the perspiratory vessels; or, lastly, by producing at once both the latter of these effects.

149. In conformity with the plan adopted on other occasions, I shall proceed to investigate the powers of this class of medicines, according to their supposed modes of operation.

the slightest exercise, whereas the cuticular discharge is at such times absolutely less. We have all experienced the sensation of heat, and disposition to sweating, during the moist weather, which so frequently occurs in this country in April and May, the wind being at the time stationary at south-west or south. On the contrary, during the prevalence of an east wind, the most violent exercise will scarcely prove diaphoretic, and yet the quantity of cutaneous exhalation is far greater than during that state of atmosphere when the slightest exercise deluges us with perspirable matter. Dr. Schmidtmeyer says that in Chili, notwithstanding the high temperature, the perspiration passes off in so insensible a form, during rides or other exertions which would have been intolerable in Europe, and would have moistened several folds of clothing, that it might have been doubted if there existed any perspiration at all.—(*Travels into Chili in the Years* 1820 *and* 1821, *by Peter Schmidtmeyer*) It is scarcely necessary to observe that the atmosphere of Chili is remarkable for its dryness.

DIAPHORETICS

Occasion their effects—

I. By Stimulating the Cutaneous Capillaries.

A. By external application.
By Stimulus of Heat, Friction, &c.

B. By medicines which enter the circulation, and stimulate the cutaneous vessels *by contact.*
Mercurials—Sulphur.

C. By medicines which act on the surface *sympathetically,* through the medium of the stomach.
Cold Drinks, &c.

II. By Increasing the General Action of the Vascular System.

Violent Exercise—Ammonia—Guaiacum—Alcohol—Warm Bath.

III. By Relaxing the morbidly constricted mouths of the Perspiratory Vessels.

Antimonials—Cold Affusion—Venesection—Saline Diaphoretics.

150. The action of the cutaneous vessels may be augmented by heat, without necessarily increasing, at the same time, that of the heart and arteries; hence it is that heat is, of itself, often sufficient to produce sweating, while it generally accelerates the operation of a sudorific medicine. To this general proposition, however, there are some very important exceptions; and, indeed, in certain conditions of the cutaneous surface, the stimulus of heat will be even found to impede, rather than to

promote, diaphoresis; thus in the hot stage of a continued fever, there would seem to exist a peculiar constriction of the perspiratory vessels, accompanied with extreme heat and dryness. In such a state, remedies of the third class must be applied, or conjoined with those of the former. The warm bath may be said to partake of *all* the qualities upon which our classification is founded; it will stimulate the cutaneous capillaries,—increase the vascular action generally, and, by its emollient powers, relax the morbidly constricted mouths of the perspiratory vessels. During the ardent heat of fever, the external application of cold is the most efficient sudorific, as the valuable reports of Dr. Currie have very satisfactorily established.

151. Although the *external* application of cold was not often employed in the hot stage of fever, until within the last thirty years, yet the administration of cold *drinks* appears to have been practised by the ancients, as an expedient to produce perspiration. Galen, and his immediate disciples, as well as the physicians of the sixteenth century, seem to have frequently administered cold water for the purpose of exciting sweat in fevers.* Celsus also describes the beneficial effects which arise from copious draughts of cold water in ardent fevers, "fereque post longam sitim et vigiliam, post multam satietatem, post infractum calorem, plenus somnus venit, per quem *ingens sudor effunditur*, idque præsentissimum auxilium est."† Cold water, when introduced into the stomach in the hot stage of fever, must produce its diaphoretic effect through the sympathetic relation which subsists between that organ and the skin. Nauseating doses of *Antimony*, and of other emetics, occasion a relaxation of the surface from the same mode of operation, and in this latter case, if the force of the circulation be at the same time increased by tepid diluents, the diaphoretic effect is more certain and considerable.

152. *Alcohol*, *Guaiacum*, and other powerful stimulants, pro-

* Lommius de Febribus. † De Medicina, lib. iii. c. 7.

duce their effects by merely accelerating the circulation; but in employing such remedies for the purpose of exciting sweat, we must be careful to adapt them to the circumstances of the case, and to the degree of action which prevails. In all febrile diseases attended with much increased heat, or connected with local inflammation, diaphoretics of this description must be very cautiously administered, for by accelerating the circulation they might counteract any benefit which they would otherwise confer by relaxing the vessels of the skin. In the whole history of medical opinions there is scarcely a theory which has proved so fatal in its practical applications as that maintained by Van Helmont and his disciples, viz., that *acute diseases were to be cured by expelling some morbific matter, after its proper concoction*—a theory which suggested the administration of the most stimulating sudorifics, together with high temperature* in every grade of febrile exacerbation. The fatal effects of such a practice during the seventeenth, and early parts of the eighteenth centuries, are incalculable, and may be very satisfactorily contrasted with the beneficial results which have accrued, in the same diseases, in the present age, from the use of diaphoretics of the refrigerant kind.

153. *Saline Diaphoretics*, as they readily pass with the chyle, may be supposed to enter the circulation, and be thus brought to act, directly, on the cutaneous vessels; at the same time it seems extremely probable that such remedies may also occasion an impression on the stomach, which is sympathetically communicated to the vessels of the skin; they have undoubtedly little or no influence on the general vascular system, and neither augment the force nor the velocity of the circulating current.

154. It is not, however, in febrile affections alone that this

* This practice is still cherished by the vulgar, especially in some of the more remote districts of the kingdom. It is with this view that the Cornish nurse continues to keep down the excess of population, by administering gin and treacle, in her smoky chimney corner, to children labouring under measles, in order to *throw out* the eruption.

class of remedies proves highly beneficial; the very intimate sympathetic connexion which subsists between the functions of the lungs and skin, renders the use of such medicines particularly advantageous in the cure of the diseases incident to the former of these organs; a fact upon which we shall hereafter offer some remarks under the history of *Expectorants.*

155. So again, in the treatment of bowel affections, in consequence of the intimate relation which exists between the cutaneous capillaries and those of the internal organs, gentle diaphoretics offer a valuable resource in their cure. How frequently do Diarrhœa, Enteritis, &c., ensue from the sudden suppression of perspiration by cold?

156. From the influence which these medicines exert upon the extreme vessels of the skin, they are also highly serviceable in various obstinate cutaneous diseases, as *Herpes*, *Lepra*, &c.

157. As evacuating the serous part of the blood must necessarily have an indirect effect in promoting absorption, *Sudorifics* have been occasionally exhibited in Dropsy, especially in that form of the disease called *Anasarca.** It has been already observed that cases too frequently occur in which the discharge of urine cannot be increased by art; upon such occasions practitioners have sometimes had recourse to a trial of Sudorifics,† but from the great difficulty which generally exists in exciting

* *M. Duhamel* has recorded the cases of two countrymen, considerably advanced in life, who were cured of dropsy by remaining for some time in a baker's oven, soon after the bread had been drawn. *Varikbillan*, ninth caliph of the race of the Abassides, is said to have been cured by a nearly similar method. His physician caused him to enter a lime-kiln soon after the lime had been removed, when in the course of a few days he was totally cured of his dropsy. The ancients excited sweating in this disease, by burying the patient up to the neck in heated sand or ashes; (*Celsus*, lib. iii. c. 30;) and Lysons cured cases by placing his patients in rooms heated to a very high temperature.

† In the history of the Royal Academy of Sciences, for 1703, a case is related of a woman, who, tired out by the protracted dropsy under which her husband laboured, *charitably* administered to him a very large dose of opium, with the intention of despatching him, but the medicine immediately produced such a copious sweat that it restored him to health!

sweating in such affections, the indication has rarely been fulfilled. Where, however, a sudorific does succeed, it is less liable to debilitate than the other alternative of a drastic purgative.

158. There is still another point of view in which the therapeutic importance of Diaphoretics may be considered. It is generally acknowledged that by cutaneous transpiration a portion of excrementitious matter is ejected from the system; hence by the failure or imperfect performance of this function, a deleterious fluid is retained which may give origin to disease; to such a cause may perhaps be attributed the generation of Calculi, and other diseases of the urinary system, as we shall have occasion to notice under the head of *Lithonthryptics*.

The increased efficacy which these medicines derive from combination with each other, will form a subject of interesting inquiry in the succeeding essay.

EXPECTORANTS.

159. Medicines which are supposed to be capable of facilitating the excretion of mucus from the breast, *ex pectore*, that is, from the trachea, and cells and passages of the lungs.

160. If the term *Expectorant* be intended to express a medicinal substance which has the power of promoting the expulsion of fluid from the lungs, by some *specific action* on the parts concerned, we can have no hesitation in at once rejecting the word, and denying the existence of such remedies: if, however, the term be received, conventionally, as comprehending all those substances which are capable, according to the state of the system in each particular case, of producing expectoration, it will be extremely proper to recognise, and practically useful to retain, such a class of medicinal agents. In order that their *modus operandi* may be correctly understood, the following classification is submitted to the reader.

A CLASSIFICATION OF EXPECTORANTS,

ACCORDING TO THEIR SUPPOSED MODES OF OPERATION.

CL. I.—MEDICINES WHICH INCREASE PULMONARY EXHALATION, AND THEREBY DILUTE THE MUCUS IN THE FOLLICLES OF THE LUNGS.

a. By removing constriction of the pulmonary exhalant vessels.

Blisters.
Venesection.
Nauseants

b. By stimulating these vessels by the *actual contact* of a medicinal substance.

Allium. *fœtid Gums.*
Scilla ?
The different Balsams.

c. By stimulating the top of the trachea, and thereby increasing the action of the exhalant vessels of the lungs, by a species of *contiguous sympathy.*

Stimulating Lozenges, Linctusses, the inhalation of certain vapours, &c.

CL. II.—MEDICINES WHICH DIMINISH THE INORDINATE FLOW OF FLUID INTO THE LUNGS, AND RENDER THE EXPECTORATION OF THE REMAINDER MORE EASY.

a. By removing the debility of the exhalants.

Sulphate of Zinc. *Bitter Tonics.*

b. By increasing the power of the absorbents.

Digitalis. *Nicotiana Tabacum.*

c. By determining to the skin by gentle diaphoresis.

Antimonii Potassio-tartras.

d. By exciting serous discharges from the bowels.

Saline Purgatives.

CL. III.—MEDICINES WHICH OPERATE MECHANICALLY, IN PROMOTING THE REJECTION OF ACCUMULATED MUCUS.

a. By stimulating the muscles of respiration.

Ammonia.

b. By exciting vomiting, aud thereby compressing the thoracic viscera.

Emetics.

I. Of Medicines which increase Pulmonary Exhalation.

a. By removing constriction of the Pulmonary Exhalant vessels.

161. There can be no doubt but that, in certain states of disease, the exhalants of the lungs, like those of the skin, are affected by a spasmodic constriction, in consequence of which the usual quantity of fluid for the lubrication of these parts is not effused, whence a train of morbid phenomena arise; this appears to happen in *Pneumonia*, *Asthma*, and certain other diseases of the pulmonary organs. In order to remove such a constriction, remedies of the antispasmodic class may be exhibited with advantage; nauseating doses of Tartarized Antimony, or of Ipecacuanha, are likewise calculated to fulfil the same indication, by an operation analogous to that by which Diaphoresis is produced. If the term might be allowed, we should call such remedies *Pulmonary Diaphoretics.* It is in this way that venesection, blisters, and other antiphlogistic remedies, may in certain states of the lungs restore a healthy excretion from these vessels.

b. By Stimulating the Pulmonary Exhalants, by the actual contact of a medicinal substance.

162. There certainly appear to be substances which enter

the circulation, and are more peculiarly determined to the pulmonary vessels, since their odour is to be distinctly recognized in the air that is expired. *Garlic* may be adduced as an example of this kind; so penetrating is its odorous principle, that if it be only applied to the soles of the feet it may be perceived in the breath. Such substances may stimulate the exhalant vessels through which they pass, and by this stimulus the secretion may be increased, and the mucus contained in the follicles diluted, so as to be poured out in a less viscid form, and consequently in a state to be more easily brought up by expectoration.

c. By stimulating the top of the trachea, and thereby increasing the activity of the exhalant vessels of the lungs, by a species of contiguous sympathy.

163. The salutary operation of those various remedies, which are allowed to pass slowly over the fauces, sufficiently establishes the fact which is here announced. In this manner I apprehend that much benefit may arise from the use of a *Linctus*, and I am satisfied from experience that certain cases of hoarseness are to be frequently removed by such an application of stimulating syrups.

164. The inhalation of certain vapours will also enable us to make a more direct application to these parts. As, however, it is my intention to dedicate a chapter to the consideration of this form of remedy, it is unnecessary to dwell upon it in this place.

II. Of Medicines which diminish the inordinate flow of fluid into the lungs.

a. By removing the debility of the exhalants.

165. It not unfrequently occurs in persons either debilitated

by age or disease, that the exhalant vessels of the lungs lose their tone, and pour out a larger quantity of fluid than is necessary for the lubrication of these organs; this is particularly observable in the disease called *humoral asthma*, and in the catarrh of old persons. If this excess be restrained by strengthening the tone of the system generally, or by astringing these vessels in particular, the expectoration of the remainder will be rendered much more easy. According to my experience, *sulphate of zinc* displays considerable powers in moderating this effusion of fluid, and it appears to produce this effect by increasing the tone of the exhalant vessels of the lungs: several medicines also, which are included in the former division of this classification, may, by stimulating these organs, not only promote the exhalation when it is too scanty, but repress it when it is too abundant.

b. By increasing the power of the Absorbents.

166. In some cases the mucous inundation may not depend upon any fault in the exhalants, but upon a torpid state of the pulmonary absorbents: our remedy for this evil is to be found amongst that class of medicines which have the power of promoting absorption, as small doses of some mercurial preparation, *Digitalis*, and perhaps *Nicotiana Tabacum*.

c. By determining to the skin by a gentle diaphoresis.

167. It is evident that an increase of the cutaneous exhalation is generally attended with a relative diminution in the other serous excretions of the body; this is so obvious with respect to our urinary discharge, that every person must have noticed the variation of its quantity at different seasons of the year. In like manner the exhalation from the lungs, although less capable of becoming an object of observation, is not less affected by the state of the cutaneous discharge; hence medi-

cines capable of promoting it are calculated to diminish the quantity of serous exhalation from the lungs; and it is upon this principle that well-regulated doses of the compound powder of Ipecacuan frequently furnish the oppressed asthmatic with a valuable resource.

d. By exciting serous discharges from the bowels.

168. Upon the principle announced in the preceding section, the operation of a saline cathartic may relieve the pulmonary organs when loaded with a preternatural accumulation of fluid, and consequently assist expectoration. On the contrary, if the exhalation be deficient, this class of remedies may increase pulmonary irritation, and check expectoration, a fact which coincides with the concurrent testimony of many able practitioners.

III. Of Medicines which operate *mechanically.*

a. By imparting vigour to the respiratory muscles, engaged in the act of expectorating.

169. It must be admitted that, to a certain extent, expectoration is a voluntary operation, connected with the action of a variety of muscles, which in a state of extreme debility are not easily excited into action: every practitioner must have noticed this fact during the treatment of the coughs of exhausted patients, and have witnessed the distress necessarily arising from it; in this condition the exhibition of a stimulant may so far renew the exhausted excitability of these organs, as to enable them to undergo the necessary exertions.

b. By compressing the thoracic viscera, through the operation of an emetic.

170. The beneficial results which frequently attend the concussion of an emetic, in cases of mucous accumulations in the

lungs, are too well known and understood to require much elucidation: in the act of vomiting, the thoracic viscera are violently compressed, the neighbouring muscles are also called into strong action, and both expiration and inspiration are thus rendered more forcible, and the expulsion of mucus from the cavity of the lungs necessarily accomplished.

The safety and expediency of such a resource must, however, in each particular case be left to the discretion of the medical practitioner. (104.)

171. Besides the remedies above enumerated, there are some others which afford relief in certain coughs, and have therefore in popular medicine been considered as *Expectorants;* but their operation, if they exert any, is to be explained upon principles altogether different from that of facilitating expectoration, and will more properly fall under the head of *Demulcents.*

172. Atmospheric changes, in relation to moisture and dryness, deserve some notice before we conclude the history of expectorant agents: the subject teems with curious and important facts, and the advantages which the asthmatic patient derives from such changes merit farther investigation. That the lungs are constantly giving off aqueous vapour is made evident by condensing the expired air on a cold surface of glass or metal; and it is easy to imagine that when the atmosphere is saturated with moisture, its power of conducting off this vapour will be proportionally diminished, and that an accumulation of fluid may thus take place in the lungs; on the other hand, we may suppose the air to be so dry as to have an increased capacity for moisture, and to carry off the expired vapour with preternatural avidity. In either of these cases the excretions from the lungs will be materially influenced, whether to the benefit or disadvantage of the patient will depend, in each particular instance, upon the nature of the disease under which he suffers. I have known a person who could breathe with more freedom in the thick fogs of the

metropolis than in the pure air of a mountainous region, and it would not be difficult to adduce many examples in illustration of a diametrically opposite constitution of the pulmonary organs.

173. From the same cause we may frequently observe remarkable changes occur in the character of a cough, at the breaking up of a frost; in some cases the expectoration will be checked, and in others promoted by a sudden change from a dry to a moist atmosphere. Can a more instructive illustration be offered of that important fact, which I have been labouring in every page to impress upon the mind of the young practitioner, that *remedies are only relative agents?*

174. In the course of considerable experience in the treatment of pulmonary complaints, and in the influence of climate and seasons upon them, I have repeatedly observed the rapid transition from moisture to dryness to occasion very remarkable effects upon the disease; and I much question whether an attention to such a condition of the atmosphere does not deserve as much consideration in the election of a suitable place of residence for such invalids, as the more obvious circumstance of temperature. I have been long in the habit of recommending to persons confined in artificially warmed apartments, to evaporate a certain portion of water, whenever the external air has become excessively dry by the prevalence of the north-east winds, which so frequently infest this island during the months of spring; and the most marked advantage has attended the practice.* But in such cases the practitioner must ever be guided by the symptoms of each particular case; it would be worse than useless to lay down any general precept for his guidance. We cannot then be surprised that such a difference of opinion should exist amongst practitioners of equal eminence, respecting the influence of a marine atmosphere; some advocating its advantages to the pulmonary

* A lady, suffering under a pulmonary affection, observed to me not long since, that whenever her hair went out of curl she was sure to be better.

invalid, and others maintaining with equal confidence the injurious tendency of such localities. Each party appeals to *experience* in justification of his opinion, and with equal candour and justice; but the cases from the results of which the medical inference has been drawn, however parallel they may have appeared, differed in those essential points to which we have alluded, and upon which the question of climate would seem to turn. There is another circumstance connected with the subject of atmospheric moisture which it is also essential to remember,—that the air gains a considerable increase in its power of conducting caloric, by becoming saturated with aqueous vapour; thus when a thaw takes place, and the thermometer rises a few degrees above 32°, the air, instead of impressing us with the sensation of increased temperature, actually appears much colder.

SIALOGOGUES.

175. Substances which increase the salivary* discharge. This class comprehends two orders of medicines, viz.

176. 1st. Those which increase the salivary excretion by *external* application to the secreting vessels, by mastication, as the following acrimonious and pungent substances, *Anthemis Pyrethrum; Colchearia Armoracia; Daphne Mezereum; Nicotiana Tabacum*, &c.

177. 2nd. Those whose *internal* exhibition affects these organs through the medium of the circulation, of which *mercury* is the only true example; for all the preparations of this metal, when administered in certain quantities, produce salivation.

178. The acrid Sialogogues, or Masticatories, by stimulating the excretory ducts, and increasing the secretion of saliva, sometimes relieve the pain of toothache, and are commonly resorted

* σίαλος, *saliva*; et ἄγω, *excito*.

to for that purpose;* they are besides supposed capable of relieving other congestions, or inflammatory dispositions, in more remote parts of the head, by the derivation they occasion from the neighbouring vessels, especially the branches of the external carotid.

179. Mercury, in its metallic state,† is perfectly inert, and does not exert any influence whatever upon the living body. This fact is sufficient, if any serious refutation were necessary, to overturn the theory which attributes its sialogogue property to the gravity of its particles, by which "it is disposed to retain the *direct line* in which it is propelled from the heart, and is therefore more certainly determined to the vessels of the head." It has been also supposed to act by diminishing the *lentor* of the blood, and disposing it to pass more easily into the salivary glands, so as to increase their secretion: equally gratuitous and improbable are the chemical hypotheses which have been offered to explain this curious and singular property. Dr. Cullen endeavoured to solve the problem, by supposing that "*mercury has a particular disposition to unite with ammoniacal salts, and that such salts are disposed to pass off by the salivary glands more copiously than by any other excretion.*" Dr. Murray, however, very justly remarks that mercury has not any peculiar tendency of this kind; and that if it had, these salts are not more abundant in the saliva than in some other secretions. Dr. Murray then proceeds to submit a theory which he considers better calculated to explain the phenomenon: he observes, that the urine appears more peculiarly designed to convey matter which has been received into the circulating mass, but which is still excrementitious, from the system. To pass, however, with this fluid, it is necessary that the matter

* The root of the *peteveria alliacea*, an extremely acrid plant, is employed by the inhabitants of Jamaica, who put a small plug of it into the diseased cavity. It is vulgarly called *Guinea-hen weed*, from the fondness this animal manifests for it in the West Indies.

† I of course except its application in the form of vapour, in which state it proves extremely active.

conveyed should be soluble in it; and when it is so, we can discover it in the secretion by chemical tests. If there is any property connected with it, therefore, which shall prevent this solubility, it probably will prevent the substance from being secreted. Now the *phosphoric acid*, abundant in urine, must in this mode counteract the secretion of mercury in any form of preparation, by forming with it a compound, insoluble, and to which the slight excess of acid cannot communicate solubility; the mercury, therefore, existing in the circulating mass, when brought in the course of circulation to the secreting vessels of the kidneys, will not pass through their whole course; but if conveyed so far as to be combined with *phosphoric acid*, will, from this combination, be incapable of being conveyed onwards, and will therefore be retained in the composition of that part of the blood which does not enter into the secretion, but returns to the circulation. It must be discharged by some other emunctory; a portion of it appears, from some facts, to pass off by the insensible perspiration: but the *tenuity* of this secretion, if the term may be employed, must be unfavourable to this mode of discharge. The salivary secretion is one by which it may be more easily transmitted; and this transmission may even be facilitated by the affinity exerted to the *oxide of mercury* by the *muriatic acid*, the *soda*, and *ammonia*, which are the chief saline ingredients in saliva; for it deserves to be remarked, that triple compounds of these substances are, to a certain extent, soluble in water; and if the *mercury* is thus secreted, it will of course stimulate the secreting vessels through which it passes, and increase the discharge.

180. Sir Gilbert Blane* has lately advanced another hypothesis to account for the effects of mercury as a sialogogue. He considers the salivary glands as one of the outlets for the *ramenta* of the bones; for by analysing the saliva we discover the principles of which they consist: indeed the osseous matter not unfrequently concretes on the teeth, and sometimes on the salivary ducts, in the form of what is called *tartar*: "does not

* Medical Logic, edit. 2nd, p. 75

this fact," says Sir Gilbert Blane, "in some measure account for these glands being the parts upon which determination is made by the operation of mercury, which consists in exciting an active absorption of solid parts, as I have elsewhere observed."*

181. But do not the kidneys, and other excretory glands, also furnish outlets through which the *detritus* of the body is eliminated? How does it happen, therefore, that the kidneys are not as equally affected as the salivary glands by the action of mercury? In the present state of our knowledge it will be more prudent to rest on the phenomenon as an ultimate fact, than in attempting to ascend higher in the scale of causes, to involve ourselves in impenetrable darkness.

182. During the prevalence of the theory which attributed to *nitric acid* all the anti-syphilitic powers of mercury, it was even maintained that this acid also excited ptyalism; experience, however, has disproved the effects thus attributed to it, and no one attempts to support its pretensions as a sialogogue, except indeed as it may, perchance, by its acrid qualities, influence the excretory ducts of the glands, externally, in the act of being swallowed.

183. It has been stated by Dr. Macleod,† that the *hydrocyanic acid* occasionally produces soreness of the gums, and a disposition to ptyalism; this, if true, is a very remarkable fact, and well deserves attentive consideration.

184. Some theorists may, perhaps, be inclined to consider certain nauseating medicines as possessing sialogogue properties. It cannot be denied that an increased discharge of saliva will take place during the operation of such remedies; but it is very transient, and can never be rendered available to any therapeutic object. I shall, however, have occasion to refer to this fact hereafter, and to the inference deduced from it by Dr. Eberle, in explanation of the effect of nauseating medicines in promoting the operation of mercury.

* Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, vol. iii. p. 119. London, 1822.

† Medical and Physical Journal for October, 1811.

COUNTER-IRRITANTS—DERIVATIVES, OR REVULSIVES.

185. These may be defined, remedies of *external* application, by which we endeavour to remove, or diminish, the morbid condition of a particular structure, by artificially creating a new irritation, or determination, in some other part, more or less remote from the seat of disease.

186. The effect thus produced has been long expressed by the term "*revulsion*;" but since in its most comprehensive meaning it would embrace too wide a field of physiological and pathological inquiry, and include the majority of those changes which are induced by such internal remedies as *cathartics*, *diuretics*, *diaphoretics*, *&c.*, it has been thought expedient, by prefixing the term *external*, to limit its signification to that class of phenomena in which the seat of irritation is transferred from an internal organ to the surface.

187. The application of a *counter-irritant*, for the relief of a labouring organ, was doubtless, suggested to the attentive observer by the occurrence of spontaneous translations of disease from one part to another, and by the obvious and immediate relief so frequently afforded by them; as, for example, in the subsidence of pulmonary and gastric irritation on the appearance of a cutaneous eruption, &c.

188. The object, then, of a counter-irritant is to produce a salutary change in an inaccessible organ, by effecting an artificial change in one within our reach, and to transfer morbid action from a structure more immediately subservient to life, to a less essential surface in sympathy with it. By a similar process we may restrain morbid secretions; for by promoting an excessive afflux, or congestion of fluids, we can establish an artificial discharge in such parts as are in relation with the peccant organ.

189. In order to render such agents available in the cure of

disease, much judgment and discrimination are required. In the hands of the inexperienced practitioner, or rash empiric, they may aggravate the evils they are intended to relieve.

190. It must be kept in view that external counter-irritants have two distinct modes of operation; the one *derivative*, by which the circulation is diverted from the affected organ, and directed upon some other part; the other directly stimulant to the system generally, or to some susceptible organ in particular; and it is a knowledge of these facts that must direct us in their application: but I shall reserve the observations I have to offer upon these points until I treat the subject of blisters.

191. When counter-irritants operate so mildly as merely to excite the capillaries without occasioning the effusion of serum, they are denominated *rubefacients;* but if, by increased strength, or continued application, they excite the extreme vessels into such a state of inflammation as to terminate in the effusion of a serous fluid between the cuticle and the skin, and thus to form a vesicle or blister; they are distinguished by the term *epispastics*, *vesicatories*, or *blisters.*

192. Various substances have, at different times, been proposed for the purpose of producing counter-irritation; such as *nitric acid—boiling water—strong acetic acid—tartar-emetic—mustard,—ammonia—nitrate of silver, &c.*

EPISPASTICS. *Vesicatories. Blisters.*

193. It is generally admitted that, in efficacy, certainty, and safety, no substance surpasses the common blistering or Spanish fly (*Cantharis Vesicatoria*) for the purpose of raising a blister.

194. By the application of this substance, whether in the form of plaster or in that of solution, the extreme vessels are excited into inflammation, and which, if carried to a sufficient extent, terminates in the effusion of serum. From this simple view of the subject, it will appear obvious that blisters may

produce their salutary effects by several different modes of operation; by a just estimate of which the practitioner will be enabled to reconcile the discordant opinions which have been delivered, and to employ these agents with greater satisfaction and advantage. Blisters may act—

As Derivatives—i. e. *By producing a diversion of the circulation from the inflamed and engorged vessels of the neighbouring organs to the blistered surface.*

195. This mode of operation was long overlooked by physicians, who ascribed all the beneficial effects of a blister to the evacuation which it produced, while the humoral pathologists, moreover, considered the matter so discharged to be of a morbific nature. That such agents, however, may owe their salutary tendency to causes independent of their powers as evacuants, is at once rendered evident by the relief which they afford when used only as rubefacients. In all inflammatory affections of the internal organs, a blister placed on the contiguous surface affords great relief, not only by the discharge it occasions, but by a transference of the inflammatory action to the surface; but in such cases some judgment is required in the application of the remedy; should the inflammatory symptoms be very considerable, and accompanied with fever, unless the general excitement be previously subdued by blood-letting, blisters will aggravate the disease. Mr. Porter, in his "Surgical Observations on the Diseases of the Larynx and Trachea," protests against the use of blisters in acute laryngitis, especially in the earlier stages; a case is also related where, in acute pneumonia, the application of a blister was followed by an aggravation of the symptoms, and death was the consequence. On dissection, a portion of the surface of the lung, exactly corresponding with the size and shape of the blister, was found in a more advanced stage of inflammation than the remaining pulmonary tissue. In my own practice I have seen the early application of blisters

obviously mischievous in pneumonia; and I am still more strongly impressed with the conviction that, in the treatment of acute hydrocephalus, the common practice of blistering the head is calculated to accelerate the fatal termination by increasing the disposition to effusion, unless the inflammatory action has been previously subdued. These observations may be extended, by analogy, to the acute affections of other vital organs; so that, notwithstanding the popular adage that "*Blisters are always safe things*," that "*if they do no good they can do no harm*," they will be found, like other potent applications, capable of producing the highest degree of mischief when directed by unskilful hands.

II. As Evacuants, *by occasioning an effusion of fluids.*

196. It was observed by Stoll that the discharge from a blister is too small to entitle it to the character of an efficient evacuant. I can only say that this does not accord with my experience; I have certainly seen not much short of a pint of serous fluid discharged in the course of forty-eight hours; and when we consider the importance of unloading the capillaries, we are surely justified in referring some portion of the benefit derived from blisters to their action as evacuants. Dr. Eberle has justly observed that the vesicated part may be considered in the light of a new excretory organ, the formation of which requires the establishment of a new current or determination of blood; so long, therefore, as the discharge continues, so long will there be an especial demand of blood in the blistered part, and a consequent derivation of the circulation from the inflamed and engorged vessels of the neighbouring organs; hence it is that an artificial discharge may check a morbid effusion, upon the well-known principle of the antagonism of secretions; by increasing one we diminish another; to this law, however, there are some important exceptions of great practical importance. There are cases in which a blister, applied too close to the organ we seek to

relieve by counter-irritation, will bring aggravation instead of relief. I have seen a blister placed on the temple for an inflammatory affection of the eye, increase the evil very considerably. Professor Müller attempts to establish a general law by which such exceptions are to be explained. He says, "the increase of a secretion in a tissue, A, which is less irritable than the organ, B, is incapable of producing a diminution in the secretion of the latter; hence it is, that the eye being more irritable than that of the skin in its vicinity, is not relieved, but, on the contrary, offended by a blister, by exciting sympathy, instead of establishing an antagonism." The nature of the fluid effused is at first serous, but after some time it becomes purulent; and this stage of its operation must, in many cases, be considered the most beneficial, and hence the value of "*perpetual blisters.*"

III. As General Stimulants, *by raising the vigour of the circulation, and stimulating the nervous system.*

197. That blisters have such a tendency, there exist too many proofs to admit of doubt; and in accordance with the general law of stimulants (58) they are followed by collapse. It is said, that whenever Dunning, the celebrated barrister, was called upon to make any extraordinary effort of forensic or parliamentary eloquence, he was in the habit of applying a blister to his chest, which he found to have the effect of imparting an unusual tone and vigour to his body, and elevation to his spirits. Hence, in low fevers they have proved valuable auxiliaries; but since, in all such cases, the application of any description of stimulus must be regulated by the degree of excitement, it is evident that they can only be made with success in particular stages; a fact which will at once explain that want of unanimity in medical writers, with respect to the value of blisters in febrile diseases. Dr. Fordyce deprecated their use under any circumstances. Rush considered that there was one particular period in the course of

a continued fever, between its high excitement, and the appearance of a collapse, in which they will generally produce unequivocally good effects, and to this he gave the name of "*blistering point.*" Acquainted as we now are with the primary and secondary effects produced by such counter-irritants, the experienced practitioner will have no difficulty in deciding this question, according to the peculiar circumstances of the case under treatment.

IV. As Antispasmodics.—*Relieving pain through the medium of sympathy.*

198. This effect would frequently appear to be independent of the operations above enumerated. The pain thus produced may probably explain the advantages derived from their application in particular instances. It has long been remarked that, by exciting one pain, we may relieve another; hence blisters have afforded relief in toothache, and other painful affections. Epilepsy and hysteria, arising from irritation, have been removed by such applications, apparently from their exciting the nervous centres, through the extremities of the cutaneous nerves.

199. Something also may be due to the power which a blister may possess to divert the attention of the patient from the seat of the disease. The importance of such a measure in spasmodic affections, has been already explained (77).

200. It has been a question whether blisters should be applied as near as possible to the affected organ, or in its vicinity, or at a considerable distance from it. Huxham maintained, on the principle of revulsion, that their beneficial influence was greater when they acted upon a part remote from the seat of disease. This, however, must depend upon the object we desire to accomplish. If to produce a constitutional effect, the locality is less important, provided the application be made to a sufficiently sensitive part. If to excite an action, to counteract a local inflammation, the

blister should be applied as near as possible to the affected part, with such exceptions as we have already stated, (195.) If to counteract spasm, it will be better to excite the artificial pain at a part distant from the seat of disease.

201. The practical management of these agents will fall under our notice in that part of the work which embraces the "ART OF PRESCRIBING."

ISSUES (*Fonticuli*) and SETONS * (*Setacea.*)

The effects of these processes bear a strong analogy to those which are produced by Vesicatories; they are, however, more permanent, and are on that account better adapted to the relief of those chronic affections which would seem to require a remedy of long-continued influence. In pulmonary affections, for instance, a seton in the side is frequently attended with very considerable benefit. The popular belief in humoral pathology, which continues to influence the mass of mankind, has perhaps assigned to these remedies a greater share of credit than that to which they are really entitled; but it must still be acknowledged that when an ulcer, having existed a great length of time, is healed, or *dried up*, or any constitutional discharge is suddenly checked, the health may become affected. In such cases the establishing a discharge by means of an Issue is undoubtedly a safe and often a beneficial operation.

CHEMICAL REMEDIES.

202. The reader has been reminded of a period in the history of medicine, when the various functions of the body

* From *Setum*, a horse-hair, a substance which was formerly used for the accomplishment of this object.

were regarded as processes wholly chemical—when diseases were referred to a similar agency, or to some excessive fermentation in the blood and fluids; and when, as a necessary consequence of this theory, medicines were only appreciated as chemical agents, calculated to control or correct such specific action. Theorists are ever disposed to run into extremes, and, accordingly, those who maintained the supreme and exclusive agency of chemistry, were succeeded by others who denied its powers altogether, and affirmed that no chemical change could ever take place in the living body, nor any chemical agent be brought to bear upon an animated structure. In their zeal to support this doctrine, we have seen that they not only denounced chemical science as utterly worthless, but upbraided it as the source of endless error; forgetting, apparently, that without a knowledge of chemical action, they could not possibly determine how far *vital* changes of composition differed, or were distinct from those which take place between the elements of inert matter; but the progress of anatomy and physiology, and in truth that of chemistry itself, has induced the habit of more correct observation and reasoning, and led to wider and less exclusive views; and chemistry and physics are once more allowed, without prejudice, to sit in council upon every examination into the phenomena of living nature.

203. The great controversy to which we have alluded, like most of those which occupy the pages of medical history, is in a great degree *verbal;* the ideas attached to the term *chemical* have not been sufficiently distinct and definite, and each writer has accordingly moulded, and adapted the definition, so as to suit his own preconceived opinions and views. Dr. Hodgkin has justly observed that,* " whatever changes are produced in the proportion and mode of combination of the elements of which bodies are composed, must, when not

* Provisional Report of the Committee of the Medical Section of the British Association appointed to investigate the composition of secretions, &c.—*Transactions,* vol. vi.

merely mechanical, be essentially *chemical*, and that the introduction of an agent, though it be no less important than the influence of LIFE, does not in any degree detract from its chemical character. We have merely to consider that the elements both act, and are acted upon, under peculiar circumstances, which offer some analogy to what is seen when chemical elements are exposed to the influence of caloric or electricity; their inherent properties are not destroyed, but they are modified when they are placed under these influences; and as the investigation of chemical changes, in which the two influences just mentioned are concerned, has tended greatly to improve our knowledge in respect to them, so we may reasonably hope that a similar result may be obtained from the investigation of the processes of nutrition and secretion going forward in living bodies, by regarding them as strictly chemical, even in those very modifications which vitality produces."

204. It is evident that an organized body cannot generate matter, but can only change the modes of its combination, and that its sustenance and reproduction must depend upon the chemical transformation of the substances which are employed as its nutriment, and which contain its own elements. It is at the same time admitted that the attractions which take place under the influence of the vital principle, are generally essentially different from those, by which the same elements are actuated in the laboratory of the chemist; and hence we recognise the existence of a distinct set of laws, determining and regulating the combination and decomposition of all bodies appertaining to living structures, to which the general title of VITAL AFFINITIES has been applied; but the combinations having been thus determined, chemistry furnishes no farther analogies. The form which matter subsequently assumes is entirely due to vital power, which has nothing in common with physical agency; how, for instance, can we explain, as Liebig observes, its tendency to take the form of globules, or rather of cells, in which a containing cyst, and a

contained matter are usually discernible? We may, by chemical agency, produce the constituents, but we can never mould them into an organized tissue, or an organic cell.

205. In order to avoid any misapprehension that may arise from the doubtful import of terms, the reader is desired to keep in mind the following definitions;—CHEMICAL CHANGES are such as take place between the constituent parts of inanimate bodies, according to certain laws of affinity, which have been established by experiment, or deduced from theory. CHEMICO-VITAL CHANGES are those transformations, or changes of composition, which result during the performance of the animal functions, but which, as far at least as the present state of our knowledge will enable us to judge, are not conformable with the laws which determine the combination and decompositions of inert matter.

206. In drawing these distinctions, it is not pretended that they have an actual existence in nature; they merely mark the boundary of our present knowledge, and may change as science progresses: indeed we have only to retrace its history, and we shall perceive that this imaginary line of demarcation has within the last few years so far altered its range as to have included within the limits of the first class (CHEMICAL) several of the phenomena which had long been regarded as exclusively belonging to the second, or CHEMICO-VITAL; as examples we might mention the formation of *Urea*, and the *Formic*, *Oxalic*, and *Allantoic*, acids, in our laboratories; or adduce instances of transformations between certain proximate principles long regarded in relation to each other, as indifferent to all change, except under the influence of vital affinities; the most remarkable of which, in every point of view, is the action of a recently-discovered substance, extracted from malted barley, termed "*Diastase*," upon starch, and which may be regarded as a probable type of numerous other transformations.*

* The microscopic observations of M. Raspail have shown that the granules of starch consist of organic vesicles, inclosing within them a

207. In the next place, Professor Liebig, by applying to chemical action the dynamic law of La Place and Berthollet; viz. *that a molecule set in motion by any power, can impart its own motion to another molecule with which it may come in contact*, has not only beautifully explained the phenomena of fermentation, putrefaction, and decay, but, by showing that a body *in the act of decomposition* may, as it were, by an influence exerted beyond the sphere of its own attractions, impart its peculiar state of transformation to compounds with which it may happen to communicate, has gone far to furnish a parallel to the hitherto mysterious process of assimilation, while it has thrown no inconsiderable light upon the action of certain organic poisons,* as will be hereafter explained.

clear, transparent, colourless liquid; when placed in water, heated to 122°, the investing membrane, which is impervious to cold water, expands, but in boiling water it bursts, and then the contained matter dissolves in the water; so that raw starch is not actually nutritive to man until it has been boiled or baked, for the heat of the stomach is not sufficient to burst all the grains of the fecula. It appears, then, that starch consists essentially of two distinct substances. 1. The liquid portion which fills each little vesicle, and, according to the experiments of M. Guerin Varry, consists of a peculiar substance in solution in water, to which he has given the name of *Amidin*. 2. The vesicular portion of the grain which is insoluble in water, and which he has distinguished by the name of *Amidine*, but as this latter term is too near that of the former, Thomson proposes to substitute for it the name of *Amylin*.

Diastase is a substance which may be extracted from the seeds of malted barley, oats, and wheat; it is soluble in water, and the solution has the remarkable property of separating the two constituents of starch from each other; hence its name (διαστημι, *to separate*); the action takes place when heated to 150 or 167; with the *Amidin*, it enters into combination and causes it to form a solution in water, while the *Amylin* separates, either falling to the bottom or floating on the surface. Such is its energy, that one part of it is sufficient to render soluble the interior portion of two thousand parts of starch, and to convert it into sugar.

* The most familiar example of this kind of action, if we except the phenomena of fermentation, is presented to us in the instance of a piece of decaying or mouldered wood, inducing the fresh wood, with which it may happen to be in contact, to undergo gradually the same change: upon a similar principle, the very finely divided woody fibre, in the *act of decay*, in moistened gall-nuts, rapidly converts the *Tannic* into the

208. As a general proposition, we are justified in regarding vitality as a power engaged in continual conflict with the physical, chemical, and mechanical forces to which every species of inanimate matter is invariably subjected. The animal machine is constantly surrounded and assailed by agents, whose elective attractions for the several principles of which it consists are so numerous and energetic, that its decomposition must inevitably and speedily result, were not the cohesion of its molecules maintained by the conservative influence of a superior power—that power is LIFE; and, as its energies decline we discover the ascendancy of chemical forces,* until, at its final extinction, the elements of which the

Gallic acid. As in these cases, the change resembles a slow combustion, in which the combustible elements enter into slow and silent combination with the oxygen of the atmosphere, Liebig has given the name of *Eremacausis* (ηρεμα slow, and καυσις burning.) Many chemical instances have been adduced by Liebig to show that "the active state of the atoms of one body has an influence upon the atoms of a body in contact with it; and if these atoms are capable of the same change as the former, they likewise undergo that change, and combinations and decompositions are the consequence. The following is, perhaps, one of the most striking. *Peroxide of hydrogen* is known to decompose spontaneously, although slowly; to yield its excess of oxygen, and to return to the condition of common water; but this change is greatly accelerated by the contact of certain bodies, such as platinum and silver, which do not enter into combination with any of its constituents. But the fact more immediately illustrative of the subject before us is this, that if certain metals thus brought into contact, be in the state of oxide, as, for instance, that of silver, all the oxygen of the metal is carried away with that evolved from the peroxide of hydrogen, and as the result of the decomposition, water and metallic silver remain; now, says Liebig, no other explanation of this phenomenon can be given, than that a body in the act of chemical change enables another body, with which it is in contact, to enter into the same state.

* It sometimes happens that the stomach and digestive organs are so weakened by disease as to lose their control, or what Dr. Fordyce called their "governing power," in which case they would appear to be unable to prevent the matters which they contain from acting chemically upon each other, and occasioning decompositions and new combinations: in such cases substances are sometimes developed in the internal organs by the action of disease, which are capable of producing a chemical effect upon the fluids; for instance, an acid is not unfrequently generated in

animal body consists, fly off in the form of Binary compounds, or, in other words, they undergo that series of changes which constitutes the phenomena of decay and putrefaction.

209. For the preservation of the living body, it was essentially necessary that it should have been endowed with a power of resistance to forces calculated to destroy it; but it by no means follows, as a corollary, that Nature will refuse the aid of such chemical powers as may assist her operations, or counteract their tendencies to error. "It would be truly extraordinary,"

the bowels of children, which decomposes the bile and produces a green precipitate, and green stools are the consequence; in other cases the acid combines with the *soda* of the bile, and the precipitate thus occasioned is thick, viscid, very bitter, and inflammable, and we have stools looking like pitch. In yellow fever, and in several other diseases, the bile which is brought up by vomiting is frequently of a vivid green colour, and some writers have attributed the phenomenon to a morbid condition, or action of the liver or gall-bladder; the fact however is, that the bile itself undergoes a chemical change in the duodenum and stomach. That bile does undergo such a change from decomposition is proved by a variety of facts observed to take place *out* of the body. It is well known, for instance, that the fæces of infants, although yellow when voided, frequently become green after some time; and Dr. Heberden observes, in his Commentaries, that the urine of a certain jaundiced patient, which was of a deep yellow, became after a few hours green: in such cases it is probable that an acid is generated by the re-action of the elements of which the bile consists.

Dr. Hodgkin observes that different tissues, while they retain their healthy condition unimpaired, resist the common tendencies of unorganized matter more or less forcibly, and apparently in each in a peculiar manner, and consequently they are enabled to maintain their own peculiar composition, notwithstanding the incessant molecular changes effected by nutrition; and where they happen to be secretory organs, the same uniformity is preserved in their products. But when they are impaired by disease, or accident, this isolating faculty is impaired, or lost. The diffusion of a diseased process, as in the instance of the degeneration of structures in the vicinity of malignant tumours, does not appear to take place, until those structures have been lowered in vitality. In like manner extravasated fluids are preserved longer in the living body, unless the vital powers are low, and, in that case, the decomposition takes place with equal rapidity. The fæces soon undergo a chemical decomposition, when out of the body, while they may remain in the intestines for a considerable period without any change.

says Liebig, "if the vital principle, which uses everything for its own purpose, had allowed no share to chemical forces which stand so freely at its disposal." In truth, the animal œconomy, in a condition of health, furnishes several obvious instances of chemical agency. What are the changes which occur in respiration, but those of chemical affinity, by which carbon unites with oxygen, and furnishes carbonic acid as the product? Is not the acidulous chyme neutralized by an alkali provided for that purpose by the bile? In the composition of urine do not its several acids divide the alkaline bases amongst themselves, in the order of their respective affinities; and are we not able to trace changes in the composition of that fluid, depending upon chemical action?—is not, for instance, the presence of crystallized *Lithic acid* to be traced to an uncombined acid, decomposing the *Lithate of Ammonia?* Then, again, the power which living animals possess of maintaining a temperature lower than that of the atmosphere, has been shown by De la Roche, Berger, and Edwards, to depend entirely on increased evaporation, and hence must be regarded as a purely chemical process.

210. It must not, however, be overlooked that, strictly chemical as those several processes may be, Nature never abandons her right to modify and control them. Dr. Prout has shown that the quantity of carbonic acid eliminated from the lungs is influenced by certain vital conditions; and Sir A. Cooper, by an ingenious set of experiments,* has very clearly proved that the chemical change of venous into arterial blood,

* He placed a ligature on each pneumo-gastric nerve of a rabbit; the animal's breathing became stertorous, and at the end of from nineteen to twenty-four hours death ensued. In these experiments it was observed that the blood circulating in the arteries gradually assumed the venous colour, and that the animal heat at the same time decreased in a remarkable degree; hence we may infer that the changes of the blood are under the influence of the nervous energy. "*Some Expt. and Observ. on tying the Carotid and Vertebral Arteries, and the Pneumo-gastric, Phrenic, and Sympathetic Nerves, by Sir A. Cooper, Bart.*" *Guy's Hospital Reports*, vol. i.

may be arrested by withholding the influence of the pneumogastric nerves; so that in these chemical processes we perceive the control of a power, distinct from those agencies which connect themselves with the phenomena of inert matter.

211. Since, then, it appears that, although the vital principle vigilantly guards the animal structure from those forces which may assail its integrity, or endanger its well-being, it does not oppose such chemical agencies as may be salutary, we surely are justified in inquiring how far a medicinal substance may be brought to act *chemically* upon the living body.

212. Dr. Prout has observed that, "those who have attempted to apply chemistry to physiology and pathology, have split on a fatal rock, by hastily assuming that what they found by experiment to be wanting, or otherwise deranged, in the animal œconomy, was the cause of particular diseases, and that such diseases were to be cured by supplying, or adjusting artificially, the principle in error;" and he emphatically adds, "but the scientific physician will soon discover that Nature will not allow him to officiate as her *journeyman*, even to the most trifling degree." Dr. Prout, I apprehend, merely intended to guard the practitioner against the numerous chemical fancies, and exclusive theories, which have so frequently seduced his judgment, and corrupted his practice; but we must not allow a metaphor to pervert truth. There are instances in which Nature evidently allows Art to act as "*her journeyman*,"—in cases, for example, of profuse sweating, or hemorrhage, or after the excessive use of saline food, the blood acquires an increased appetency for water, and readily appropriates the fluids that may be administered to supply the deficiency, although, under ordinary circumstances, they would pass off by one or other of the excretions; again, what is thirst in certain states of alimentary digestion, but an instinctive petition for water to impart a healthy state of solubility to the Ingesta, or to give a requisite degree of fluidity to the blood? Orfila has very clearly demonstrated an existing relation be-

tween the sensation of thirst, and a diminished proportion of water in the blood, by the relief afforded it from the injection of fluids into the veins; indeed, we receive from Dr. Prout himself a striking instance in which Nature would frequently find herself not a little embarrassed, without the aid of "*her journeyman.*" I allude to that part of his work in which he illustrates the importance of common salt in the animal œconomy, and the instinctive craving after that substance, so remarkably shown by animals that are deprived of it. In the course of the inquiry, I shall adduce many other instances, although I am well aware that several of them are rather apparent than real examples of true chemical action, and I shall deal with them accordingly.

213. Do not let it be supposed that I view with indifference the fallacies which have arisen, and must ever arise, from chemical theories, not immediately springing out of the examination of well-ascertained facts, and which in their details are not perfectly consistent with them; and which are, moreover, incapable of assuming, without violence to their fabric, such modifications as may be suggested and rendered imperative by the progression of knowledge. No theory can possibly have a truth superior to, or independent of, facts; and if, whenever upon the occurrence of any exceptions to our propositions, instead of modifying our theory to meet the exigency, we explain away the facts, to use the eloquent words of Mr. Whewel, "our theory, from that moment, becomes our tyrant and oppressor, and all who work under its bidding do the work of slaves, they themselves deriving no benefit from the results of their labour." But even facts, to have any value as the foundation of a theory, must have a constant relation to all the circumstances in connexion with it. The knowledge gained with regard to a medicinal substance in the laboratory, may avail little when put to the test in the ward of the hospital; and here it is that we hit the great blot of chemical pathology; in truth, the most considerable part of that discredit which has fallen upon the science, in its

relations to therapeutics, is to be attributed to the zeal of those who have given too great a preponderance to this fascinating object of their study. The mere chemist can have no pretension to the art of composing or discriminating remedies; whenever he arraigns the scientific propriety of our prescriptions, in direct contradiction to the deductions of true medical experience—whenever he forsakes his laboratory for the bedside, he forfeits all his claims to our respect, and his title to our confidence. It is amusing to see the ridiculous errors into which the chemist falls when he turns physician; as soon as Seguin found that Peruvian bark contained a peculiar principle that precipitated *tannic acid*, he immediately concluded that this *could be no other than gelatin;* and upon the faith of this blunder, the French, Italian, and German physicians* gave their patients nothing but clarified glue in intermittents. Under the guidance of the same false lights, we find the chemist engaged in multiplied experiments upon different substances on the blood and fluids of the body, in order to deduce, from the results obtained in test-glasses and crucibles, the nature and extent of their powers as agents upon the living frame; thus, the *spirit and salts of hartshorn*, as they were found to render the blood more fluid, when added to it *out of the body*, were indiscriminately administered in almost every complaint, with a view to dissolve that "*lentor of the fluids*" which was regarded by the disciples of Boerhaave as the more general cause of disease. In our own times we have heard of the solution of albumen for the cure of contraction and rigidity of the tendons, a practice founded on the fact that the white of an egg will render leather supple. But we must not be deterred from the pursuit of truth by the failures of ignorance, nor aspire to become the "*journeyman*" of Nature before we have industriously served her as the apprentice.

214. We have presented the chemist in a disparaging point

* This practice was introduced into France by Seguin, into Italy by Couticiri, and into Germany by Bischoff.

of view. Let us reverse the picture, and contemplate the practical physician, deeply versed in all the phases of disease, but unacquainted with chemical science. He will watch with skilful attention every turn of the disease, and he will, as far as his experience goes, meet it with a suitable remedy; but is he perfectly acquainted with the composition of his medicines?—can he know the modifications produced in them by his own prescription?—can he predicate the changes they may possibly undergo in their transit through the stomach and system?—can he explain their effects upon the excretions?—is he prepared to offer a conjecture as to the cause of their failure, or untoward action? These, and many more questions connected with the importance of chemical knowledge for the successful administration of remedies, will present themselves for investigation in the third part of this work.

215. With regard to the action of medicines as *chemical agents*, it appears to me that the subject may be discussed under the following heads.

1. *Can we, by chemical means, supply the living body with such materials as may be deficient?*
2. *How far are we able to neutralize, annul, or remove, offending materials by chemical agency?*
3. *Can we oppose and counteract, by chemical means, any undue ascendency of chemical forces in the living body?*
4. *Are there any agents by which we can, chemically, influence animal temperature?*

216. As to the first of these questions, since *chymification* must be regarded as the earliest link in that important series of changes, by which food is converted into blood; and since the stomach is, of all the internal organs, the most accessible to external agency, the question as to whether, and to what extent, it may be possible to supply any solvent capable of

assisting that function, or to administer any remedy calculated to correct its aberrations, must at all events vindicate its claim to a priority of notice. But there is, moreover, another and an equally cogent reason for placing this question in the foremost rank of the inquiry, viz. that the philosophical physician should be acquainted, as far as our limited knowledge extends, with every fact connected with the chemistry of the stomach and alimentary canal. It is very true that the vital affinities may baffle any attempt to reconcile with chemical laws the changes his remedies may undergo *in transitu;* but exceptions will occur, and chemical science may in such cases explain apparent anomalies, which must remain as sealed mysteries to those who do not possess it.

217. The first agent with which food or medicine comes into contact is the Saliva; and considerable doubt has existed as to whether it possesses any power, beyond that of simple dilution, in the process of digestion. Tiedemann and Gmelin believe that its different salts give a slight solvent property to it; and Leuchs has stated that it has the property of changing starch into sugar; a fact which has received the confirmation of Schwann.* The subject is interesting, and there are circumstances, connected with its re-agency upon several medicinal substances, which claim for it an importance which it has not hitherto received. The *Saliva*, so called from the saline qualities which it possesses, when first discharged from the mouth is always more or less mixed with mucous matter, the effect of which is to impart a frothy quality, by enabling the fluid to retain the air absorbed from the atmosphere.

* The digestion of starch in dilute acid does not give rise to the formation of any sugar; but Schwann digested in some acidulated saliva for twenty-four hours a certain quantity of boiled starch, then filtered the fluid, and found that *iodine* produced in it no change of colour. Having neutralized it, and evaporated it to dryness, he obtained from the residue, by means of alcohol, a considerable quantity of sugar, which he recognised by its taste, as well as by its property of fermenting with yeast.

This mucus is readily separated by merely diluting the saliva with distilled water, when it will gradually subside.

218. Thus freed, from what may be considered as extraneous to the secretion, saliva has been chemically examined by Berzelius, Tiedemann and Gmelin, Mitscherlich, and other eminent chemists; the result of their experiments has shown the existence of a peculiar *salivary matter*, the nature of which has never been exactly defined; together with various saline bodies in solution, as *Chloride of Sodium*, *Lactate of Potass*, *Soda*, *Lactic acid*, *Phosphate of Lime*, certain *Ammoniacal Salts*, and some *Silica*. In addition to which, Tiedemann and Gmelin have inferred the presence of *Sulpho-cyanogen*, from the fact that saliva becomes of a deep-red colour when mixed with a neutral solution of a salt of the *peroxide of iron*. It is, however, probable that the saline composition of this fluid varies very considerably under different circumstances; without this admission it is difficult to reconcile the discordant statements regarding its most obvious property. Tiedemann and Gmelin found it to be generally slightly alkaline, sometimes neutral, but never acid; and Schultz says that the saliva of the human subject is generally alkaline: I confess this does not accord with my own observations, which have been numerous. I have generally found it neutral, except in cases of disease, when it has generally been acid,* seldom alkaline, although I have found it in such a state, accompanied with more than a usual proportion of mucus. The saline compounds appear to be readily decomposed; on placing some litmus paper upon the tongue, and connecting it, as in the common galvanic experiment, with a piece of silver and zinc, the portion of the paper in contact with the

* While preparing this sheet for the press, I have seen a patient, whose saliva instantly reddened litmus paper, as if it had been placed in a strong acid; upon exposing it to heat, the blue colour was restored; the acid was therefore volatile, probably the *Acetic*. I ought to state, that in this case there was not the slightest evidence of any morbid acidity in the stomach.

positive metal became red, and, by reversing the experiment, the blue colour was restored. If the saliva be triturated in a glass or porcelain capsule with a fixed alkali, ammonia becomes evident from its odour; indeed it is to such a decomposition of the ammoniacal salts that M. Chevreul attributes the urinous taste of the fixed alkalies. M. Mialhe, moreover, supposes that the saliva has the property of converting a portion of calomel into corrosive sublimate; in order to be convinced of this fact, he says, it is only necessary to hold a small quantity of calomel in the mouth for a few minutes, when a pretty intense mercurial taste will be developed, which he considers due to the mutual reaction of the mercurial and alkaline chlorides in the saliva. We require farther experiments upon this subject, and I venture to hold out the inquiry to those who have leisure to pursue it, as being one very likely to lead to some curious results. That the saliva possesses properties which have never been appreciated,* I cannot entertain a doubt; although it must be confessed, that the experiments of Berzelius and others would appear to negative the idea of its producing any dynamic effects on alimentary substances submitted to its action.

219. Although in a state of health we are not sensible, by the taste, of the presence of saline matter in the mouth; yet, when the stomach has been long empty, and the nervous system has acquired an increased sensibility, the saline taste is frequently perceptible. The same effect happens in disease, and the disagreeable flavour of which invalids complain must be referred to some chemical changes having taken place in the secreted fluid.

220. On the subject of the gastric secretion, I shall state,

* I am by no means disposed to place amongst the "*Aviæ antiquæ*," the popular belief in the power of the saliva as an application to relieve the irritation arising from the sting of venomous insects, and other acrid matter, or to assuage the itching of certain cutaneous affections; upon what its soothing property depends, I will not pretend to explain; but I know that it is far superior to any mucilage that can be artificially prepared.

shortly, all that the latest researches in physiology and chemistry have made known, and the practitioner will then be in a position to form a judgment as to how far such knowledge may be applied to practical purposes. In the examination, however, of this important question, let us be careful that we are not influenced by the authority of those who, although wise in their generation, had not enjoyed the advantages of modern science. Dr. William Hunter, whose peculiar sagacity and precision of mind detected at a glance the mischief that must arise from the adoption of theories of digestion, founded alone upon the loose analogies of mechanical or chemical philosophy, expressed himself with that solidity of judgment and facetiousness of expression which rendered him unparalleled as a public teacher. "Gentlemen," said he, "physiologists will have it that the stomach is a mill—others, that it is a fermenting-vat—others, again, that it is a stew-pan,—but, in my view of the matter, it is neither a mill, a fermenting-vat, nor a stew-pan—but a STOMACH, gentlemen, a STOMACH." Now, that this opinion of Dr. Hunter should not carry more weight than its author intended, it must be remembered that, at the period at which he lectured, there was a strong disposition to refer the phenomena of digestion to the sole operation of mechanical or chemical causes, to the total exclusion of vital influence; and we may readily concur in the justness of such a censure, without excluding the collateral assistance which such sciences may afford.

221. All the theories advanced for the explanation of the process of digestion have borne the impress of the prevailing science; the belief, therefore, in a specific gastric solvent may date its origin from chemical physiology; but so contradictory were the earlier accounts of its nature, that we cannot be said to have attached any distinct ideas to it before the researches of Prout, Tiedemann and Gmelin, Chevreul, and other contemporary experimentalists, and which have been so happily confirmed by the invaluable observations of Dr. Beaumont. To this acute and diligent physician the rare

opportunity occurred of studying the phenomena of chymification in a youth named St. Martin, the interior of whose stomach was exposed to view in consequence of a gunshot wound; and to his accurate and persevering observations, continued through a considerable period, we are indebted for information of the utmost value; not only was he thus enabled to explore the stomach, while empty, but to obtain and examine its contents through all the successive stages of digestion, and to remove every doubt that might exist as to the secretion and agency of a specific gastric juice. Having ascertained that the stomach was empty, and that its coats gave no evidence of the presence of a free acid, he irritated it mechanically, by introducing through the wound a caoutchouc tube, or the bulb of a thermometer, and observed each time that a tolerably copious acid secretion was poured out from minute lucid points, or very fine papillæ; so that by these means he was frequently able to obtain nearly an ounce of the gastric secretion, which he describes as being a clear transparent fluid, without smell, slightly saltish, and very perceptibly acid. Its taste resembles that of thin mucilage slightly acidulated with muriatic acid. It is readily diffusible in water, wine, or spirits, and effervesces with carbonated alkalies; it precipitates albumen; itself undergoes putrefaction with difficulty, and checks its progress in other animal substances. Mixed with saliva, it strikes a blue colour and becomes frothy. Dr. Beaumont submitted a certain quantity for analysis to Professor Duglison, who found it to contain free muriatic acid, acetic acid, phosphates, and muriates of potass, soda, magnesia, and lime, and an animal matter which was soluble in cold, and insoluble in hot water.* Dr. Beaumont has further proved what Spallanzani and others had attempted to establish, under less favourable circumstances, that the fluid secreted by the stomach has the power of dissolving articles of food, *even out of the animal body.*

* For the above account I am indebted to Müller's Elements of Physiology by Baly.

222. To the same enterprising observer we are indebted for some pathological facts of high importance; he has shown, for instance, that during a feverish state, whether induced by excess in spirituous potations, or by any other cause disturbing the nervous system, the villous coat of the stomach becomes sometimes red and dry, and at other times pale and moist, and loses altogether its smooth and healthy appearance. In consequence of which the usual secretions become vitiated, or entirely suppressed; and the mucous membrane no longer affording its bland secretion, the nervous and vascular papillæ are exposed to undue irritation; and not the smallest portion of *Gastric juice* can be procured on the application of the usual stimulus of food. The knowledge which is thus afforded will lead the physician to modify the activity of his remedies;* and, as we shall hereafter show, sanction the propriety of many esteemed combinations. On the other hand, there is frequently a morbid state of the stomach and alimentary canal, accompanied with such an excessive secretion of mucus, as to impede the operation of the usual remedies.

223. With respect to the chemical nature of the gastric fluids, I believe that Dr. Prout was the first to detect the presence of *Hydrochloric acid;* and physiologists, who are too frequently led to the hasty generalization of a single fact, immediately recognized in this acid the active solvent of the food. Eberle found that although neither dilute acids, nor mucus, alone possessed the property of rapidly dissolving organic substances submitted to their action, yet that mucus mixed with acids did possess such power; but Eberle generalized too far, when he stated that *all* mucus in an acid state displayed a solvent action, which Schwann and Müller subsequently found to belong exclusively to the mucus of the gastric membrane. The former of whom, after various experiments, established the

* It will also throw some light upon apparent anomalies in Dietetics, and explain why pulpy and gelatinous food, which, in ordinary cases of Dyspepsia, would be regarded as objectionable, should be received with less inconvenience by the stomach.

following important facts:—1st. That a digestive fluid may be artificially prepared by acidifying, with hydro-chloric acid, an aqueous infusion made with the membrane of the fourth stomach of the calf. 2nd. That the digestive principle thus produced will retain its specific solvent power for months, after the acidulated infusion has been filtered. 3rd. That the dilute acid, without undergoing any change itself, aids, by its presence, the decomposition of the organic matter, just as it aids the conversion of starch into sugar when boiled with it. 4th. That the presence of the acid is essential and indispensable, since the liquor, by being neutralized with carbonate of potass, entirely loses its solvent power, but regains it by the addition of a sufficient quantity of hydro-chloric acid. 5th. That in digestion, as in fermentation, a very small quantity of the decomposing agent is sufficient to produce the effect; but that the action of the digestive fluid differs from that of a ferment, inasmuch as it loses its power, during its action, without, as happens in fermentation, the generation of a fresh portion; besides which, during the process of artificial digestion, the presence of oxygen is not necessary, nor is any carbonic acid given off.

224. It is evident, then, that by the action of the acid upon the gastric mucus a peculiar digestive principle has been developed, or formed; and to this hypothetical body, for such it undoubtedly must be considered, since it has never been obtained in a separate state, the term PEPSIN has been given; and the following are its essential characters. It is soluble in water, and dilute muriatic and acetic acids; it is not precipitated by alkalies, but it is thrown down from its neutral solution by *Acetate of Lead*, and can be recovered from this precipitate, in its active state, by means of sulphuric acid. *Corrosive sublimate* produces a precipitate both in the acid and neutral fluid; *Tannic acid* also throws down from it a precipitate; *Alcohol* and the boiling temperature cause turbidity in it; and all three render the fluid inert.

225. Whether we shall ever be able to supply the deficiency of gastric juice by an artificial compound, is a question which

naturally presents itself. The objection easily urged against such a supposition, that the absence of the gastric secretion is but a symptom of a more latent disorder, may be answered by observing that, however unscientific it may be to prescribe for symptoms, instead of seeking to remove their cause, there are many exceptions to such a rule; without giving an undue latitude of application to the facts above stated, it is not unphilosophical to suppose that an organ in a state of collapse may, when once aroused, be enabled to continue its functions, and that no excitant could be introduced more likely to affect its sympathies than one analogous to its own proper stimulus. Is it not probable that the mineral acids invigorate the appetite by some such process? At all events, the knowledge we have thus acquired with respect to the gastric juice will give weight to a practice that experience has already sanctioned, that of exhibiting dilute *Hydrochloric acid* in certain cases of disordered digestion; it will also point out the periods at which it should be given, and guard us against the indiscriminate and unseasonable use of alkalies. It may, moreover, lead to the explanation of certain changes to which our remedies are exposed in the stomach.

Can we supply Principles supposed to be deficient in the Blood?

226. That the composition of this vital fluid undergoes various injurious changes under the influence of disease, no one at the present day can entertain any doubt; and in commencing our inquiries into the means which science may suggest for their correction, we are at once brought into contact with the theory of Dr. Stevens,* which ascribes to the deficiency of *saline* matter in the blood certain febrile diseases, which he proposes to cure by the administration of saline medicines. Dr. Stevens is an ingenious and enterprising theorist,

* "Observations on the Healthy and Diseased Properties of the Blood."

and it is amusing to see how he elbows his way through a crowd of difficulties, until he gets a clear path to the temple of his presiding deity; but, like most enthusiasts, he shows no toleration to those who differ from him. Although his premises are false, and his reasoning generally fallacious, his experience has enabled him to collect certain facts which merit attention. If disease ever depends upon the deficiency of saline matter in the circulation, there is nothing physiologically inconsistent in supposing that the due administration of it may act as a remedy, since we have seen that foreign bodies can be absorbed into the blood, and upon some occasions be permanently retained by it; nor should the invigorating effects produced by the injection of saline solutions into a vein in cholera be disregarded: it is true that we have hitherto only succeeded in thus producing a transient revivification, but our trials have been few and partial; and more extended experience might improve the practice. I have already observed that there are many exceptions to that general rule of not prescribing for symptoms, and this is evidently one; for if we can only succeed in keeping the patient alive for a few hours, the morbid cause, as in the case of a poison, may be thrown off. In a race against time, such expedients are of the highest importance.

227. The next question to which this train of inquiry conducts us, regards the deficiency of colouring matter (*the red globules*) of the blood. That in chlorosis and various cachectic diseases there is such a deficiency, is at once shown by the blanched countenance, and other indications derived from the state of the capillary circulation, while an examination of the blood itself will confirm the fact. How far iron can be regarded as the colouring principle of *Cruorin* is still a question, but no doubt can exist that this metal, in some state of combination, is one of its essential constituents;* and that, in the diseases above stated, it is deficient in quantity. *Can iron*,

* In the former editions of this work I have expressed a different opinion, but I have found reasons for changing it.

therefore, act as a chemical remedy? Experience says that its preparations are most beneficial in such cases;* but even admitting this, it may be said to act as a *vital* agent, imparting vigour to those organs by which blood is made; we, however, know that under its use the colouring matter is increased in its proportion; and we have moreover learnt, that such forms of the metal as are more readily absorbed into the blood, are those which prove most eminently efficacious.† It is then not unreasonable to conclude, that they actually become combined with the blood, and are, therefore, *Chemical* agents. It is a strong argument in favour of the virtues of iron, that it has

* In the article *Anème* of the Dictionnaire de Medecine, by M. Chomel, there is a very interesting and instructive account of the *Anæmia* with which the coal-miners of Anzaim were afflicted. It seems to have originated from deficient sun and air. On examination after death, the arteries and veins were found destitute of coloured blood, containing only a little serous fluid. Mercury appeared to be unsuccessful, but the beneficial influence of iron was most marked. In eight or ten days there was an evident amendment, several veins had appeared under the skin of the fore-arm, and the patients, on each successive day, pointed out new veins, as discoveries, which had not been perceived before.

† Woehler has stated that he could not discover iron in the urine of those to whom it had been administered. In these cases it must have passed off with the feculent discharges, or been retained in the blood or textures of the body. On the other hand, we shall find in the second volume of the Bologna Commentaries, a very complete series of experiments upon dogs, which fully proves the absorption of the metal. Forty of those animals were fed with food containing iron in different states; when, after death, *more iron was found in their blood than in that of the same number of dogs fed in the usual manner;* and the quantity varied according to the nature of the preparation employed; those, for instance, fed on iron ore had three times more in their blood than those who took no iron with their food; those fed with iron filings had the next greatest quantity, and those who took the peroxide the least. Dr. Home of Edinburgh tested the urine of a man to whom he had given a large quantity of the tincture of the chloride, and it afforded evident proof of the presence of iron; but the absorption is slowly effected, and appears to require several days before its evidence can be obtained. The fact would seem that, in certain conditions of the body the iron is absorbed, in others discharged with the contents of the bowels. The *protoxide* is also more readily assimilated, the *peroxide* less so, and therefore it is found in the urine.

been employed in all ages,* and by the disciples of the most adverse schools; indeed, from its acknowledged powers, it has been enlisted into the service of every ascendant theory; and it is not a little singular that speculative opinions, however different and even adverse, do nevertheless often coincide in matters of practice, as well with each other, as with long established empirical usages, each bending, as it were, and conforming, in order to do homage to truth and experience. I shall presently endeavour to show that iron may possibly exert a different chemical influence, in effecting salutary changes in the body.

228. In those diseases in which there is a deficiency of bony matter, as in the *Rachitis* of children, and the *mollities ossium* in advanced life, physicians have occasionally given the salts of lime, but never, as I believe, with advantage. Nor has the morbid disposition to deposite specific matter ever been checked by the exhibition of acids. Such diseases depend upon a loss of balance in the vessels engaged in the appropriation, and in those destined to carry off such matter; or, in some defect in the vital action of the textures with which the inorganic matter forms an union. In such cases, therefore, we must discard chemistry, and call physiology in aid of our therapeutics; we have to support and strengthen nature by generous diet, pure air, cold-bathing, and frictions, in order, by *vital* stimulants, to aid her self-adjusting powers.

How far are we able to neutralize, annul, or remove offending materials by CHEMICAL *agency?*

229. During the ascendancy of the humoral pathology, the

* It is true that there are some exceptions. At one period, the ancients imagined that wounds inflicted by iron instruments were never disposed to heal; for which reason Porsenna, after the expulsion of the Tarquins, actually stipulated with the Romans that they should not use iron, except in agriculture; and Avicenna was so alarmed at the idea of its internal use as a remedy, when given in substance, that he seriously advised the exhibition of a magnet after it, to prevent any direful consequences.

belief in a corrupt condition of the fluids, as being exclusively initiative of disease, gave origin to numerous remedies that were supposed "to cool, sweeten, attenuate, clear, and correct the blood;" now, without falling into the extreme error of this theory, or supposing with Cullen, that certain medicines act only on the fluids, and others as specifically on the solids, it may be reasonably asserted, that the blood may become impure, and during its circulation carry mischief to every organ of the body; nor is it at all unreasonable to suppose that medicines may be introduced which are calculated, during their passage, to combine with and abstract from the blood certain offensive materials, and convey them to some excretory portal; physiologically speaking, it is impossible to conceive that fluids can undergo a change without imparting an influence to the solids, nor that the solids can be altered without involving the fluids; each to each is indispensable. The great fallacy of the school of the Fluidists was its exclusiveness, and the Solidists were equally in error in not giving due importance to the morbid alterations of the fluids; such is the intimate alliance between these two parts of the same whole, that if either be regarded apart from the other, we step beyond the magic circle,—our wand is broken—and the genius of true philosophy abandons us to our own conceits and misapprehensions.

230. That the blood is constantly liable to variations in the relative proportions of its elements is a fact that does not admit of any dispute; and there can be no doubt that it is also liable to become contaminated with matters foreign to its nature. The presence of bile in hepatic diseases is too obvious to require a remark; and in consultation with Dr. Baillie, a few months before his death, he told me that, although he had never published the opinion, he was perfectly satisfied that the blood underwent a very considerable change, and was surcharged with alkaline matter, in cases of protracted disease of the liver. But there are other changes, not so apparent, but equally influential and injurious; and the digestive organs are

probably the common source from which they spring. When the assimilation is imperfect, the fluids removed by venous absorption from the stomach into the portal circulation are apt to be loaded with impurities, and the excretory organs are thus called upon for an extraordinary exertion; should they fail, the blood may become surcharged with deleterious matter. Ramazzini, more than a century since, noticed and ascribed the unhealthy aspect of sedentary artisans to the retention of *excrementitious* matter; but this subject has been lately most ably examined by Dr. Barlow, in an admirable essay, published in the Encyclopædia of Practical Medicine, under the title of "PLETHORA," which, like all that he has written, well deserves the attention of the practical physician. He recognises two distinct and very different conditions under this term, viz. *nutritive* and *excrementitious* plethora; it is to the latter that our observations will apply. It must be remembered that the object of the present work is not to give a history of disease, or of methods of cure, but to examine certain principles which are to direct us in the use and application of particular remedies; it is therefore essential that in the following observations I should not be misunderstood, and that the reader should not receive *special* for *general* directions. In describing the possible *modus operandi* of an alterative remedy, it is not to be supposed that its use is advocated to the exclusion of other plans of treatment. If it be shown that a certain agent may assist in eliminating specific impurities, it does not follow that it is to supersede such general and acknowledged methods of cure as may be calculated to increase the activity of the organs of excretion.

231. It must be admitted that imperfect assimilation may allow certain impurities to find their way into the circulation; or, should the emunctories which, in a state of health, are the channels through which useless and broken-down parts are carried off in peculiar forms of combination, fail in their office, matter highly deleterious to the well-being of the body will accumulate, and become the active source of disease. Now,

Berzelius considers the peculiar product of organized matter undergoing decomposition in the *living* body, as a step towards its removal, to be LACTIC ACID; and its excess, in certain states of the system, as discovered in the excretions, more especially in that of sweat, renders such a supposition highly probable. One of the chemical peculiarities of this acid is the facility with which it dissolves bony matter; in cases, therefore, of "*mollities ossium*," it might be well to keep this fact in remembrance. It may also become a source of irritation to glandular structures; and, by acting upon the filaments of the nerves, give rise to neuralgic pains.* Now, it so happens that, in all those affections in which theory might suggest a state of impurity arising from the retention of decaying materials, *Protoxide of Iron* has proved eminently beneficial, and chemistry has taught us that this is, of all bodies, that for which the *Lactic acid* has the greatest affinity; may it not, then, act by clearing out such remains of this impurity as the emunctories have failed to eject? If so, chalybeate waters must afford a form of preparation eminently calculated for the purpose, by finding their way through the mazes of the circulation, and acting at the same time on the organs of excretion; and if vapour-baths be simultaneously employed, we shall have accomplished all that theory can suggest; but be this theory what it may, the practice is unquestionably valuable; and, after all, what is theory but a general expression of facts? and, as long as we do not go beyond the facts, a practice founded upon theory cannot differ from one based upon experience.

232. One of the most valuable preparations of iron is that directed in the Pharmacopœia under the title of "*Mistura Ferri Composita*," in which the metal is in a state of *protocarbonate*. In addition to its general properties as a mineral tonic, I am satisfied, from ample experience, that it exerts a specific action upon certain morbid conditions of the mucous

* It was not till long after this section of the work had been written, that the new edition of Dr. Prout's work, "On the Nature and Treatment of Stomach and Urinary Diseases," made its appearance.

membrane of the alimentary canal; through its means I have frequently succeeded in arresting the progress of that diseased state of the mucous lining indicated by a red tongue, and pultaceous evacuations resembling pea-soup. Its most remarkable effect is that of diminishing the frequency of such discharges, when the ordinary medicines have failed. Its action may, probably, in some cases, be due to its astringency, correcting that passive state of dilatation of the alimentary capillaries, described by Andral, and to which I have already made an allusion (90). At the same time, I am disposed to believe that the iron may exert a chemical action upon certain injurious matters in the *primæ viæ*, of which Lactic acid may constitute a part; and I have observed that as soon as the fæces have become tinged by the metal, the improvement has taken place, and the motions have assumed a more consistent and figured form. The same reasoning might be pursued in explanation of the effect of this remedy as an anthelmintic, the presence of *Entozoa* being always connected with a corrupt state of the alimentary secretions. I have alluded, upon a former occasion, to the efficacy of the *Tris-nitrate of Bismuth* (3) in relieving obstinate gastrodynia, and pyrosis, after the failure of other means, and I have generally connected the relief afforded with the appearance of slate-coloured motions; it is, therefore, not improbable that some acrid and irritating matter had combined with the oxide, and passed off with the excrement. In those cases of Dyspepsia accompanied with eructations that are described as resembling the taste of rotten eggs, I have found the Bismuth decidedly beneficial; where this symptom occurs, we may infer the existence of great alimentary disturbance; the vital affinities, by which the digestive changes are produced, would appear to be arrested by a chemical ascendency, and *Sulphuretted Hydrogen* (a binary compound) is one of the results; there may also be other complementary compounds simultaneously developed. Adopting the views of Dr. Prout, (33,) we may infer that Albumen is the principle from which it is generated, since sulphur is one of its incidental

elements. In treating the subject of Antidotes, I shall have occasion to relate the efficacy of the *Sesqui-oxide of Iron*, in combining with Arsenious acid, so as to form an *Arsenite of Iron*. What remains to be said upon the subject of neutralizing and removing offensive matters from the body by *chemical* agents, will more properly fall under the consideration of *Antacids—Antilithics—Antidotes*, and *Escharotics*.

Can we oppose and counteract by chemical means any undue ascendency of chemical forces in the living body?

This is a question which will be presently discussed under the head of "ANTISEPTICS."

Are there any agents, by which we can, chemically, influence animal temperature?

We shall dispose of this subject under the consideration of "REFRIGERANTS."

REFRIGERANTS—*Temperants.*

233. Substances which diminish the force of the circulation, and reduce the morbid heat of the body, without occasioning any diminution of sensibility or nervous energy.

234. These remedies may be considered either as external and local, or as internal and general. In the first case, there will not be much difficulty in substantiating their claims to be considered *Chemical agents*, but in the latter case the theory of their operation is unsatisfactory and obscure; and even the facts which are adduced to establish the existence of such a class of remedies are of a very problematical character.

235. TOPICAL REFRIGERANTS.—In the case of external inflammation, refrigeration may be produced by applications of low temperature, such as cold water, ice, or certain saline bodies in the act of solution, or by the abstraction of heat by

means of evaporation, which is very effectually accomplished by the use of lotions composed of spirit of ether. A convenient mode of keeping up a uniform evaporation, for reducing the temperature of any part of the body, as in the case of fractured limbs, &c., is to allow the gradual distillation of water upon it, through the medium of skeins of cotton, or strips of linen rags, so disposed as to act the part of a syphon, which is readily accomplished by placing one end of the wet cotton in a basin of water, and allowing the other end to hang down over the vessel. In applying such means, however, care should be taken that the part be freely exposed to the air; I have known an evaporating lotion duly applied according to the directions of the physician, but *cautiously* covered up by the nurse, from the fear of exposure to cold. Dr. Currie relates an anecdote highly illustrative of the subject; that of a shipwreck, in which the mariners, who died from excessive cold, had been only occasionally washed by the surge, while the survivors had been constantly immersed in the water.

236. By such methods we are capable of directly diminishing the activity of the vessels of the part, as, for instance, in burns and scalds, the pain is instantly relieved, and the inflammation effectually reduced; although, in directing such applications, we must take care not so far to reduce the vitality as to endanger the life of the part, and to induce gangrene. We are also to understand that by such topical applications we may affect the system generally, upon a physiological principle already explained, (42, 92,) and thus convert a local into a constitutional influence.

237. Internal Refrigerants.—There are certain saline bodies which, by undergoing a rapid solution, and thus acquiring an increased capacity for caloric, produce a diminution of temperature; and if this takes place in the stomach, the sensation of cold which it will produce is equivalent to a partial abstraction of stimulus; which, being extended by sympathy to the heart, occasions a transient reduction in the force of the circulation, and by this, or by a similar sympathetic

affection, causes a sensation of cold over the whole body. In this manner, Dr. Murray explains the refrigerant operation of *Nitre*, which, after all, is of a very doubtful nature; we shall, however, not feel much difficulty in acknowledging the principle, that general refrigerating effects may be produced by occasioning an impression of cold upon the stomach.

238. The theory which is advanced to explain the refrigerant operation of vegetable acids, acescent fruits and herbs, and certain other substances which we shall have to consider, is based upon those chemical views respecting animal heat, in which the consumption of oxygen in the act of respiration is considered the principal source. Dr. Murray,* who has given a luminous exhibition of this theory, says, "It is established, by numerous experiments and observations, that the quantity of oxygen consumed in the lungs is materially influenced by the nature of the ingesta received into the stomach. When the food and drink are composed of substances which contain a small proportion of oxygen, it is known that the consumption of oxygen in the lungs is increased, and this even in a short time after the aliment has been received. Thus Mr. Spalding, the celebrated diver, observed that whenever he used a diet of animal food,† or drank spirituous liquors, he consumed in a much shorter time the oxygen of the atmospheric air in his diving-bell; and he had, therefore, learnt from experience to confine himself to a vegetable diet, and to water for drink, when following his profession. During digestion, too, it was established by the researches of Lavoisier and Seguin, that a larger proportion of oxygen than usual is consumed. Now, if the animal temperature be derived from the condensation of oxygen gas by respiration, it must follow that an increase in the consumption of that gas will occasion a greater evolution of caloric in the system; while a diminution of it will have an opposite effect. If, then, when the temperature of

* System of Materia Medica, vol. i. p. 453.

† The same fact has been long known to the divers in the Indian pearl-fisheries, as mentioned at page 34.

the body is morbidly increased, we introduce into the stomach substances containing a large proportion of oxygen, especially in a loose state of combination, we may succeed, according to this theory, in reducing the general temperature. This, it is suggested, we may accomplish in part by a vegetable diet, but still more effectually by the free use of the *vegetable acids*, which are readily acted upon by the digestive powers, and assimilated with the food ; and as the large quantity of oxygen which they contain is already in a concrete state, little sensible heat can be evolved during the combination of that element with the other principles of the food. The nutritive matter which is received into the blood, containing thus a greater proportion of oxygen than usual, will be disposed to abstract less of it from the air, during its transmission through the lungs, and consequently less caloric will be evolved ; the temperature of the body will be reduced ; and this again, operating as a reduction of stimulus, will lessen the number and force of the contractions of the heart."

239. Such is the philosophical web which chemical ingenuity has wove for us,—the device is beautiful, but the fabric will be found too frail to endure the touch. The experiments of Dr. Crawford, in proof of the chemical origin of animal heat, are highly ingenious and plausible, and we cannot but feel a deep regret that our faith in their truth should ever have been shaken ; but it is now generally admitted that the temperature of animals derives its origin from a living principle, although the absorption of oxygen, in the act of respiration, may indirectly contribute to its production, as a stimulus to the nervous power which produces it ; for oxygen plays an interesting and active part, as an exciting agent, throughout all nature, both animate and inanimate. If the heat of the body depended upon respiration alone, any one might, by a voluntary effort of quick, deep, and prolonged respiration, increase it at will ; the effect also of the emotions of the mind, in generating heat, or repressing its evolution, is a sufficient proof that it depends on a vital, and not a chemical cause. Besides which, the ex-

periments of Sir B. Brodie have gone far to prove that the animal temperature is produced and regulated by the nervous energy. He found, for instance, that the action of the heart can be maintained by artificial respiration after the brain is removed, and that, although the blood undergoes its ordinary changes, yet that animals, under such circumstances, cool very rapidly.

240. Dr. Stevens admits that "the acids reduce the force of the circulation, but attributes this effect to a sedative operation, by which the stimulating power of the vital current is diminished.* Professor Müller† explains the action of the cooling salts on the blood in the treatment of inflammation, by supposing that they produce some change in the fibrin, which counteracts the great tendency that it has in inflammation to accumulate and coagulate in the vessels of the inflamed organ, and on the surface of membranes after exudation. An opinion deduced from the action of certain salts upon fresh human blood, which when added to it, have been found to prevent its coagulation.

241. We might have left the theory of Dr. Murray in the obscurity into which it had fallen, had it not acquired a renewed interest from the one lately proposed by Professor Liebig,‡ for the purpose of explaining the conversion of the salts of organic acids into carbonates during their transit through the body, as so frequently alluded to in the present work, (35,) and which theory, like that of Dr. Murray, seeks to establish certain chemical relations between the functions of the digestive and respiratory organs. "The conversion of these salts of *organic* acids into carbonates," says the Professor, "indicates that a considerable quantity of oxygen must have united with their elements. In order to convert *one* equiva-

* Stevens on the Blood, p. 329.

† Elements of Physiology, by J. Müller, M.D., &c. Translated by W. Baly, M.D., p. 126.

‡ "Organic Chemistry, in its Applications to Agriculture and Physiology.

lent of *acetate of potass* into the carbonate of the same base, *eight* equivalents of oxygen must combine with it, of which either *two* or *four* equivalents (according as an acid or neutral salt is produced) remain in combination with the alkali; whilst the remaining *six* or *four* equivalents are disengaged as free carbonic acid. There is no evidence presented by the organism itself, to which these salts have been administered, that any of its proper constituents have yielded so great a quantity of oxygen as is necessary for their conversion into carbonates. Their oxidation can, therefore, only be ascribed to the oxygen of the air. During the passage of these salts through the lungs, their acids take part in the peculiar process of *Eremacausis*, (slow combustion,) which proceeds in that organ; a certain quantity of the oxygen gas inspired unites with their constituents, and converts their hydrogen into water, and their carbon into carbonic acid. Part of this latter product (*one* or *two* equivalents) remains in combination with the alkaline base, forming a salt which suffers no farther change by the process of oxidation; and it is this salt which is separated by the kidneys or liver.* It is then evident, from this theory, that the presence of organic salts in the blood must produce a change in the process of respiration. A part of the oxygen inspired, which usually combines with the constituents of the blood, must, when they are present, combine with their acids, and thus be prevented from performing its usual office. The immediate consequence of which will be the formation of arterial blood in less quantity, or, in other words, the process of respiration must be retarded."

242. Whether we adopt the theory of Murray or that of Liebig, it is clear we are led, although by a very different train

* It is worthy of notice that "neutral acetates, tartrates, and citrates, placed in contact with the air, and at the same time with animal or vegetable bodies in a state of *Eremacausis*, produce exactly the same effects as we have described them to produce in the lungs. They participate in the process of decay, and are converted into carbonates just as in the living body."—*Ibid.*

of reasoning, to the same result,—that organic salts and acids, when introduced into the system, have the effect of diminishing the proportion of oxygen absorbed by the blood during the act of respiration. But the theory of Liebig assigns the chemical change which converts the organic salt into a carbonate, to the absorption of oxygen in the lungs, whereas it is my belief that the vegetable acid (e. g. the *acetic*,) is decomposed in the stomach by the ordinary powers of digestion, and that the alkaline base is there eliminated in the state of carbonate, or at least that it acquires carbonic acid during its transit (35.)

ANTACIDS.

243. These are remedies which obviate acidity in the stomach and alimentary canal, by combining with the acid and neutralising it.

244. We are here then presented with the most decided and obvious instance of chemical action which occurs in the history of medicinal operation. We have an acid, whose presence excites morbid symptoms in the *primæ viæ*, immediately removed, and its effects as instantaneously arrested, by the administration of such chemical substances as are capable of neutralising an acid *out of the body*, and for which the same proportions are required in both cases for saturation. If a carbonated alkali or earth be employed, the same disengagement of *carbonic acid* takes place in the stomach as would occur in the laboratory, and a new compound is produced, whose operation will vary according to the chemical nature of the antacid employed; thus the salt which *magnesia* forms with the gastric acid proves slightly purgative, while that with *lime* is distinguished by an opposite property; and it would appear that the saline compounds formed by the fixed alkalies

have a tendency to act upon the kidneys. It is necessary to observe, that the stomach is not the exclusive seat of morbid acidity; it may exist in any part of the alimentary canal, but more especially in the *cæcum*, where vegetable food has been supposed to undergo a second digestion;* in this latter case, the patient is not infested with acid eructations, but he experiences various uneasy sensations in that region. The seat of the acidity should therefore direct us to the appropriate remedy. In cases of *cæcal* acidity the fixed alkalies will not always be effectual, as they may be neutralised or absorbed before they can reach the part in question; for that reason magnesia is to be preferred. In certain cases, alkaline or saponaceous enemata may be useful to neutralize acidity in the lower bowels. Under some circumstances *Carbonate of Ammonia* has an advantage over the fixed alkalies as an antacid, in consequence of its being able to neutralize a portion of the acid matter which appears to exist in a gaseous state in the stomach, and which on that account will elude the action of soda or potass. But it may be said that, after all, by the exhibition of such remedies we only attack a symptom, and that we ought to look for permanent relief to a plan that may invigorate the digestive organs; this is very true, but let it be remembered that, by allowing such a source of mischief to continue, the sympathetic may preponderate over the primary irritation, and thus occasion a diversion of disease to the kidneys or some other organ.

245. Practitioners have generally regarded potass and soda as antacid remedies, between which there did not exist any material difference; to this, however, there is one very important exception;—where our object is to correct the *Lithic Acid* diathesis, potass should always be preferred to soda, since the latter alkali forms a less soluble salt with the acid in question, and is therefore liable to increase a tendency to urinary deposits. The observations of Dr. Prout have satisfactorily confirmed the truth of this reasoning, and he has

* See my work on Diet, edition 5th, p. 92.

therefore recommended *potass-water*, in preference to *soda-water*, as a beverage under such circumstances: and in deference to this opinion, the College have now introduced into the Pharmacopœia a formula for the preparation of "Liquor Potassæ Effervescens."

ANTIDOTES.*

Syn. Alexipharmics, Alexiterials, Counter-poisons.

246. Medicines which are capable of connteracting the fatal virulence of a poison.

247. There is, perhaps, no subject upon which the credulity of mankind has been more extravagantly exercised than upon that of Poisons; nor is there any class of remedies whose reputation has suffered so many vicissitudes from the caprice of hypothesis, as that of Antidotes.

248. It is not my intention, on the present occasion,† to enumerate the many very extraordinary virtues which credulity has, at different times, assigned to such medicines; nor shall I consume the time of the reader by attempting to expose the absurdity of those fearful powers with which ignorance, terror, and imposture, have invested certain poisons,—a subtlety so

* The word literally signifies a thing given in opposition to something, else, (from αντι, *against*, and διδωμι *I give*,) although now generally understood as applying to such remedies as are capable of counteracting poison; it formerly bore a much wider acceptation, as signifying any compounded medicine: thus, *Peter Damian* speaks of a person, who in his whole life never took an antidote. It has been used by some authors for any remedy for any disease, especially if it be inveterate, and arise from some ulcer or abscess; and, lastly, the term has been employed to signify a perpetual form of medicines, otherwise called *Opiates*, or more properly *Confections*.

† The subject has been fully treated in the second volume of our work on Medical Jurisprudence.

extreme as to defeat the most skilful caution, and a virulence so manageable as to be capable of the most accurate graduation; so that, while the former attribute was believed to insure their deadly operation, although exerted through the most secret and least suspicious medium, as that of boots, gloves tapers, or letters,* the latter was imagined to enable the accomplished assassin to measure the allotted moments of his victim with the nicest precision, and to occasion his death at any period that might best answer the objects of the assassination.† The abandonment of such notions may be considered as one amongst the many advantages which have arisen to medicine from the cultivation of the collateral branches of science.

249. Each of the three kingdoms of nature furnishes a number of poisons, the investigation of whose chemical properties and physiological actions, of the symptoms to which their administration gives rise, and of the lesions of structure which they occasion, together with the medical treatment they require, constitutes an elaborate branch of science, designated by the term Toxicology. It cannot be expected that I should enter upon so extensive a field of inquiry—nor can it be necessary, as the profession are

* *John, King of Castile,* as Tissot relates, was poisoned by a pair of boots, prepared by a Turk. *Henry VI.*, by gloves; *Louis XIV.*, and *Pope Clement VII.*, by the fumes of a taper, and our *King John* in a wassail bowl, contaminated by matter extracted from a living toad. To these few instances of credulity may be added the offer of the priest to destroy *Queen Elizabeth,* by poisoning her saddle, and the *Earl of Essex,* by anointing his chair. Bishop Burnet, in the History of his Own Times, (vol. ii. p. 330,) says that some believed *Charles the Second* to have been poisoned through the medium of snuff.

† This conceit does not appear to have been confined to the ignorant ages, for we learn from Spratt's History of the Royal Society, that very shortly after the institution of that learned body, a series of questions was drawn up by their direction, for the purpose of being submitted to the Chinese and Indians, which clearly shows their belief in the possibility of such an operation, viz. "Whether the Indians can so prepare that stupifying herb, datura, that they make it lie several days, months, years, according as they will have it, in a man's body, without doing him any hurt, and at the end kill him without missing half an hour's time?"

already in possession of the admirable work of Dr. Christison;* which embraces in its range all that science can impart, and all that practice can require; but, in accordance with that important rule by which every part of a system should work in unison, and minister to the perspicuous consistency of the whole, I am bound to furnish such general principles as may direct the practitioner in the selection and adaptation of the remedies best calculated to counteract the consequences of poison. I shall therefore proceed to inquire how far a *chemical* agent may be capable of neutralizing, or of decomposing, a poisonous substance in the human body; and I shall endeavour to ascertain the degree of confidence to which it may, in each particular case, be entitled; equally important will it be to learn, whether certain *vital* agents may not be serviceable in such cases, either by promoting the elimination of the poison, or by inducing a state of the system best calculated to resist its deleterious influence.

250. It may be safely asserted, that we possess very few true antidotes; for although several of the mineral poisons may be neutralized or decomposed by various re-agents, yet their destructive action is generally so rapid, that the mischief is effected before any remedy can be brought to bear, or any chemical decomposition can avail; while, in other cases, the substances resulting from the chemical action will prove as poisonous as the original ingredients, as, for instance, in the case of the decomposition of *Corrosive Sublimate*, by the alkalies and earths, when the precipitated oxide will prove as virulent as the original salt; but to this general rule there are some important exceptions, to which I shall presently direct the reader's attention.

251. To *vital agents* the practitioner must look for succour; but before we can establish any general rules for the treatment of poisoning, it is essential that we should be able to distin-

* A Treatise on Poisons, in relation to Medical Jurisprudence, Physiology, and the Practice of Physic. By Robert Christison, M.D., &c. Edition 2nd.

guish between the different modes by which poisons produce their effects, or, at least, to determine the parts of the living system through which they act; for it will be found that each poison has its own *modus operandi;* from the knowledge of which we can alone derive the particular indications of cure.

252. The hypotheses devised by the ancient physicians to account for the destructive powers of these substances were principally derived from mechanical notions respecting the supposed form of their particles, (p. 44,) which they imagined capable of lacerating and disuniting the animal fibres by the sharpness of their spiculæ;* it is, however, now satisfactorily established that the action of a poison in the human stomach is very rarely *mechanical;* sometimes *chemical,* but for the most part *vital.*

253. Poisons differ essentially from each other, as well with respect to the particular organs they affect, as the different channels through which they enter the system. Some, for instance, if introduced into a wound, will prove speedily fatal, whilst they may be taken into the stomach with complete immunity, as in the case of the venom of the viper and other snakes; other poisons, on the contrary, display their deleterious action on the stomach alone, such as caustic acids and alkalies, and several chemical poisons; while there are many which are equally destructive, whether applied to the inner membrane of the stomach, or to that of the lower intestines, in the form of clyster, or even to the mucous membrane of the mouth or nose, to the eye, to the vagina and orifice of the uterus, or to an abraded part of the skin.

254. There is, moreover, a class of substances which may be termed *aërial* poisons, for they exist in the state of gas, or are

* Dr. Meade adopted this opinion, but he became so convinced of its inadequacy, that, in the later editions of his work on Poisons, he withdrew the hypothesis. It is hardly necessary to observe that, upon its abandonment, a host of popular antidotes at once fell into disuse; for so long as the injury was supposed to arise from mechanical irritation, oils, fats, and other similar remedies, were held capable of obtunding the acrimony.

held dissolved in the atmosphere, and may be thus received through the medium of respiration, or through the mucous membranes of the nose and throat; the saliva may thus also afford a vehicle for transferring various subtle poisons from the atmosphere to the animal body. This part of the subject, however, may be more conveniently considered under the head of *Antiseptics* and *Disinfectants*.

255. A poison will differ in the celerity and virulence of its operation, according to the vascularity and absorbing power of the part to which it is applied, although several apparent exceptions to this law might be adduced; and it is evident that the plethoric state of the part with respect to its blood-vessels has a considerable share in modifying the effects;* this observation, however, can hardly apply to those poisons which operate on the system through the communication of the nerves. Sir Benja-

* The introduction of poisons into the body through the medium of the circulation of the blood is frequently alluded to by the physiologists of the seventeenth century. I have lately met with a curious passage in a work entitled "Popular Errours in Physick, first written in Latine by the learned physitian, James Penrose, Doctor in Physick. London, 1651." "The venome is carried by the veines and arteries, as appeares in that all the blood of them that have been bitten by a viper doth turne into a pale greennesse. And seeing that the veines in the papps are so very slender, and doe not come unto the heart, but with a great many long windings, I affirme, and it is more probable, that if the viper be applyed to the feet, which are farthest remote from the heart, it will sooner infect the heart than if to the papps, but soonest of all if it be applyed to the armes. And now the story of Cleopatra comes to my minde. Petrus Victorius blames the painters that paint Cleopatra applying the asp to her papps, seeing it is manifest out of Plutarch in the life of Antonius, and out of Plinie likewise, that she applyed it to her arme. Zonaras relates that there appeared no signe of death upon her, save two blew spots on her arme. Cæsar also, in her statue which he carryed in tryumph, applyed the aspe to her arme; for in the armes there are great veines and arteries, which doe quickly and in a straight way convey the venome to the heart, whereas in the papps the vessels are slender. And therefore in Saint Paul, the miracle was so much the greater, in that he felt no harme from the viper, which layd hold on his hand, for if it had assailed him on the breast, he had had respite enough to take some antidote."

min Brodie, for instance, found that the poison of bitter almonds acted more speedily when applied to the tongue, than when injected into the intestines, although the latter presents a much greater absorbing surface.

256. Foderé, in the fourth volume of his *Medecine Legale*, has arranged poisons according to the symptoms which they produce on the living system; he has thus reduced them into six classes; viz.—

1. Corrosive or Escharotic, as the Preparations of *Mercury, Arsenic, Antimony, Copper, Tin, Zinc, Silver, Gold, and Bismuth.* The *concentrated Acids, Caustic Alkalies,* and *Earths; Cantharides; Glass, and Enamel Powder; Diamond dust,** &c.

2. Astringent Poisons. Of which the preparations of *Lead* constitute the only species.

3. Acrid or Rubefacient Poisons; which, with a few exceptions, are furnished by the vegetable kingdom, as certain *drastic purgatives, Hellebore, Euphorbium,* &c.

4. Narcotic Poisons. *Opium, Henbane, Stramonium, Hydrocyanic acid,* and the vegetable bodies containing it.

5. Narcotico-Acrid. Embracing such articles as produce

* There can be no doubt but that death has been produced by the mechanical operation of various insoluble bodies; although we cannot believe the numerous tales recorded on the subject of diamond-dust (supposed to constitute the basis of the celebrated "Powder of Succession") or of powdered glass, &c. Numerous cases are recorded where life has been destroyed by the lodgment of substances in the intestines; and we have lately heard of the fatal effects produced by alvine accumulations from the habitual use of magnesia. With respect to the danger from the ingestion of glass and enamel in powder, there still exists much difference of opinion; Caldani, Mandruzzato, and M. Le Sauvage report experiments made upon men and animals, in which no bad consequences followed: on the other hand, Schurigius (Chylologia) and Cardanus (De Venenis) cite instances where persons have died of ulcerations of the stomach from such causes; and M. Portal, Foderé (Medecine Legale), Plouquet (Comment. super Homicid.), Stoll (Ratio Medendi, part vi. p.60), Gmelin (Hist. General. de Ven. Mineral.), Frank (Man. de Toxicol.), furnish testimony in support of the opinion which assigns to such bodies a highly deleterious action.

the united effects of the two former, and which constitute some of the more deadly poisons, as the *Ticunas*, *Nux Vomica*, *Belladonna*, *Tobacco*, *Hemlock*, *Digitalis*, &c.

6. Septic Poisons. *Contagious Miasmata*, *putrid exhalations from animal matter*; *Sulphuretted Hydrogen*; *the venom of the Viper*, &c.

257. The value of this classification has been very justly stated to consist in its combining, to a certain degree, the advantages of a pathological arrangement with those of one founded on the basis of natural history; for, while it is strictly pathological, it at the same time distributes the different poisons, with some few and unimportant exceptions, in an order corresponding with that of their natural history. The first two classes, for instance, present us with substances of a mineral origin; the third and fourth, with those which are chiefly of a vegetable nature; and the sixth, with objects derived from the animal kingdom. The importance of acknowledging a division which has a reference to the organic and inorganic kingdoms is considerable in a chemical point of view; for, in enumerating the various experiments to be instituted for the detection of poisons, we are thus enabled to bring together a connected series of processes, nearly allied to, ultimately connected with, and, in some respects, mutually dependent upon, each other. At the same time it must be acknowledged, that this classification has many defects, and some fallacies. In the first place, it has little or no reference to the enlarged views of the modern physiologist, respecting the "*modus operandi*" of poisons; nor, indeed, is its construction susceptible of such corrections and modifications, as can ever render its improvements progressive with the advancement of science. In the next place, the classes are in many particulars ill defined, and indistinctly, if not erroneously, divided; how questionable, for instance, are the boundaries which separate several of the species of *corrosive* from those of *acrid* poisons? And although the distinctions between the extremes of the two classes are broadly marked, the re-

spective species of each are, in many cases, less allied to each other, than are the great divisions to which they are subordinate. Compare, for example, the physiological actions of *Arsenic and Corrosive Sublimate*, both of which are arranged under the class of Corrosive Poisons. The former of these substances undoubtedly occasions death by being absorbed into the system, and thus acting as a *vital* agent; the latter, although its secondary and remote action, by absorption, may occasion mischief, should the animal survive its primary operation, kills by a local action, as a caustic on the textures to which it comes in contact. In the same manner, if we examine the individual actions of the different species composing the class of "*Acrid* Poisons," we shall perceive the same want of uniformity: thus, the *Spurge Flax*, and the *Jatropa Curcas*, act by occasioning local inflammation; whereas the *Hellebore* exerts a fatal action on the nervous system, and produces only a slight inflammation. The class of Narcotic Poisons is certainly more absolute in its definition, and more uniform in its physiological affinities; but the propriety of the class *Narcotico-acrid*" is by no means so unexceptionable; indeed, Orfila questions, while he retains it, "because the narcotic or sedative effects only follow the previous excitement." Some of the poisons of this class are also rapidly absorbed, and act through the medium of the circulation, on the nervous centres, without producing any local inflammation; while others, on the contrary, merely act upon the extremities of the nerves, with which they come in contact, and, without being absorbed, occasion death by a species of sympathetic action.

258. Orfila, in his essay on the treatment of poisoning, so far modifies the classification of Foderé, as to include all poisons under four classes, viz. Irritants—Narcotics—Narcotico-acrids, and Septics or Putrefiants. Dr. Christison, while he adopts the three first, repudiates the last, since, in his opinion, "no poison can cause putrefaction in the living system;" but are we all agreed as to the precise ideas attached

to this term? Upon this point I shall hereafter have occasion to offer some remarks.

259. From these cursory observations the reader will readily perceive, how hopeless must be any attempt to produce a classification of these bodies that is not open to numberless objections; but it is surely desirable that, as far as we are able, we should form an arrangement that may be available to the physician in the treatment of cases of poisoning, who can only derive his plan of cure from a knowledge of the physiological action of the substance with which he has to contend. I shall, therefore, adhere to the arrangement which has been published in the successive editions of this work, although I concur with all that Dr. Christison has said to its disparagement. I freely admit the difficulties which necessarily arise from so many of the poisonous substances having a double action; but I still think, as our great object, in a practical view of the question, is, if possible, to ascertain and keep in mind the *primary* operation of a poison, the arrangement which I have proposed is not without some value.

A SYNOPTICAL TABLE OF POISONS,

ARRANGED ACCORDING TO THE DIFFERENT PRIMARY OPERATIONS, BY WHICH THEY PRODUCE THEIR EFFECTS; WITH A VIEW TO FURNISH A GENERAL THEOREM FOR THE ADMINISTRATION OF ANTIDOTES.

CLASS I.—POISONS WHICH ACT PRIMARILY, BY THE TRANSMISSION OF AN INFLUENCE THROUGH THE MEDIUM OF THE NERVES.

Order 1. *By which the functions of the nervous system are suspended or destroyed.*

(*Death by suffocation, from paralysis of the respiratory muscles.*)

Alcohol.	Essential Oil of Almonds. †	Opium? †
Aconite.	Salts of Lead. †	Oil of Tobacco.
Camphor. ‡	Croton Tiglium. ‡	Hydrocyanic acid.

Order 2. By which the heart is rendered insensible to the stimulus of the blood.

(*Death by syncope.*)

Infusion of Tobacco. Upas Antiar.

CLASS II.—POISONS WHICH, BY ENTERING THE CIRCULATION, ACT THROUGH THAT MEDIUM, WITH DIFFERENT DEGREES OF ENERGY, ON THE HEART, BRAIN, AND ALIMENTARY CANAL.

(*Death in many forms.*)

Arsenic.	Meadow Saffron.	Deadly Nightshade. †
Emetic Tartar.	Squill.	Hemlock.
Muriate of Baryta.	Lettuce.	Coculus Indicus.
Hellebore.	Henbane.	Oxalic Acid. ‡
Savine.		

CLASS III.—POISONS WHICH, THROUGH THE MEDIUM OF THE CIRCULATION, EXPEND THEIR ENERGIES UPON THE SPINAL MARROW, WITHOUT DIRECTLY INVOLVING THE FUNCTIONS OF THE BRAIN.

(*Death by Tetanic convulsions.*)

Nux Vomica—and the whole tribe of *Strychnus*.

CLASS IV.—POISONS WHICH PRODUCE A DIRECT LOCAL ACTION ON THE MUCOUS MEMBRANE OF THE ALIMENTARY CANAL.

(*Death by Gangrene.*)

Corrosive Sublimate. †	Verdigris.	Chloride of Tin.
Sulphate of Zinc.	Nitrate of Siver. †	Concentrated Acids.
Caustic Alkalies.	Cantharides.	Bryony.
Elaterium.	Euphorbium.	Colocynth.
Hedge Hyssop.	Ranunculi.	Nitre. †

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† This mark denotes that the substance, against which it is placed, may also act by being absorbed.

‡ Signifies that the article has also a local action.

260. The *First Class* of our arragement comprehends such poisons as operate, through the medium of the nerves, upon the organs immediately subservient to life; in their application it is obvious that they cannot require to be introduced into the stomach; they may convey their destructive influence by an application to any part duly supplied with nerves, and whose extremities are exposed to their action. It had been long admitted that a poison might occasion death, by acting on the nerves of the stomach and intestines without being absorbed; but to the experimental labours of Sir Benjamin Brodie * we are principally indebted for our present correct views of the subject. The class admits of two important divisions; into one, comprehending those poisons which destroy the functions of the brain, and into another, including those which direct their influence upon the heart. We shall offer a few observations upon the facts which have suggested such a division, and upon the practical advantages which may attend its adoption.

261. It was observed by *Bichât*, and the observation has been fully confirmed by *Brodie*, that the influence of the brain is not *directly* necessary to the action of the heart; and is *immediately* necessary to life, only because the muscles of respiration owe their action to its influence.† For when the

* See "Experiments and Observations on the Different Modes in which Death is produced by certain Vegetable Poisons." By B. C. Brodie, Esq. F.R.S. in the 181st volume of the Philosophical Transactions for the year 1811.

† M. Lallemand has published the history of a fœtus, in which the brain and spinal marrow were equally deficient, notwithstanding which it even exceeded the usual size; the heart was also perfect; and it was evident that the circulation had been properly performed. No sooner, however, was the monster born than it perished, because the diaphragm and other muscles of respiration were unable to perform their functions without the aid of nervous excitement; no air was therefore inhaled into the lungs, and in a few minutes the heart ceased to contract, from the deficient supply of oxygenized blood. See MEDICAL JURISPRUDENCE, Vol. II. "On the Physiological Causes and Phenomena of Sudden Death."

functions of the brain are destroyed, even when the head is removed, the heart continues to contract for some time afterwards, and then ceases, only in consequence of the suspension of respiration, which is under the direct influence of the brain. Assuming this as a fact, it will appear evident that certain poisons may, by affecting the brain, so paralyze the muscles of respiration, as to occasion death by suffocation; and by such a mode of operation I imagine that those substances, arranged in the former division of my first class, destroy life. Sir B. Brodie accordingly found that, by the administration of a large dose of alcohol to a rabbit, the pupils of its eyes became dilated, the extremities convulsed, and the respiration laborious; and that this latter function was gradually performed at longer and longer intervals, until at length it finally ceased. Two minutes after the apparent death of the animal, he opened the thorax, and found the heart acting with moderate force and frequency, *circulating dark-coloured blood;* he then introduced a tube into the trachea, and produced artificial respiration by inflating the lungs, by which means he was enabled to sustain the action of the heart at its natural standard, in the same manner as in an animal from whom the head had been removed. The same phenomenon resulted from the injection of two drops of the *Essential Oil of Bitter Almonds*, diffused in half an ounce of water, into the rectum of a cat; and from the application of the empyreumatic Oil of Tobacco to the tongue and rectum of cats and dogs. Now it is obvious, that the functions of the brain are so immediately disordered by the influence of these poisons, as to have rendered their absorption very improbable.

262. Although the general proposition seems to be established, that the brain is not *immediately* necessary to the action of the heart, yet it must not lead us to the conclusion that the heart is therefore incapable of being affected by violent impressions on the nervous system; the fact is quite otherwise, for although the brain may be removed, and the circulation be nevertheless maintained by artificial respiration, yet an

injury of another kind inflicted on the brain, may be followed by those immediately fatal consequences which decapitation itself would not produce; thus a blow on the head is commonly followed by syncope, and there are certain poisons that would seem to act in a similar manner, such as the *infusion of tobacco*, which suspends the action of the heart long before the animal ceases to respire, and kills by producing syncope.* It is sufficiently obvious, therefore, that the second division of

* It is a very curious fact, that the *oil* of tobacco should differ so essentially in its physiological action from the *infusion;* the former affecting the functions of the brain alone, while the latter, when taken into the alimentary canal, suspends the action of the heart. This apparent anomaly, at first, led Sir B. Brodie, as he had since informed me, to suspect the accuracy of his experiments; and I suggested to him whether a probable explanation might not be derived from the chemical researches into the composition having shown the existence of two active principles, viz. *Nicotina* and an *essential oil* (*Nicotianin?*) Where an infusion is employed, we seem to obtain the influence of the former, and the effects are displayed upon the heart; but when the *oil* is applied, the *Nicotina* being removed, the brain is alone affected by the *Nicotianin*. Might not the "*juice of cursed hebenon,*" by which, according to Shakspeare, the king of Denmark was poisoned, have been the essential oil of tobacco?

> . . . . . "Sleeping within mine orchard,
> My custom always of the afternoon,
> Upon my secure hour thy uncle stole
> With juice of cursed hebenon in a vial,
> And in the porches of mine ears did pour
> The leperous distilment."

In the first place, the learned commentator, Dr. Grey, observes that the word here used (*Hebenon*) was more probably designated by a metathesis either of the poet or transcriber, for *Henebon*, i. e. henbane. Now it appears from Gerarde that "*Tabaco*" was commonly called Henbane of Peru; (Hyoscyamus Peruvianus;) and when we consider how high the public prejudice ran against this herb in the reign of James, it seems not unlikely that Shakspeare should have selected it as an agent of extraordinary malignity. No preparation of the hyoscyamus, with which we are acquainted, would produce death by the application to the ear, whereas the essential oil of tobacco might possibly have such an effect. The term distilment has also called forth a remark from Stevens, which is calculated to support this conjecture. "Surely," says he, "the expression signifies that the preparation was the result of a distillation."

the first class of our arrangement is justified by theory, and confirmed by experiment.

263. We come now to speak of the *Second Class*,—of those poisons which enter the circulation, and act through that medium on the heart, brain, and alimentary canal. These organs, however, are affected in very different degrees by different poisons, or even by the same poisons under different circumstances. *Sir B. Brodie* has shown that certain vegetable poisons, although when introduced into the alimentary canal affect life, in consequence of the nervous sympathy which subsists between these surfaces and the common sensorium, yet, that the same poisons applied externally to a wound, produce their effects exclusively through the medium of the circulation, being conveyed to the brain only by mixing with the blood in its vessels, and not by being conveyed through the lymphatics, for a ligature upon the great blood-vessels prevents their producing deleterious effects; whereas a ligature upon the thoracic duct, or general canal through which all the absorbents pour their contents into the blood, does *not* in the least retard or prevent the operation of the poison. There are also several of the mineral poisons which, whether introduced into the stomach, or applied externally to a wound, poison the animal in consequence of being carried into the circulation. It had long been supposed that Arsenic occasioned death by inflaming the stomach; but *Sir B. Brodie* has very satisfactorily shown that its influence arises from its absorption, and that it must be regarded rather as a *vital* than as a *chemical* agent. In the first place, he has found the inflammation of the stomach, in several cases, so slight, that on a superficial examination it might have been easily overlooked; and, in most of his experiments with arsenic, death took place in too short a time to be considered as the result of inflammation; and in the next place, in whatever manner the poison is applied, whether *externally* to a wound, or *internally* to the membrane of the stomach, the inflammation is confined to the stomach and intestines; and,

indeed, it is commonly more violent, and even more immediate, when applied to a wound, than when internally administered; and it also precedes any inflammation of the wound. This important fact was proved by an experiment made by Mr. Hunter and Sir Everard Home, and subsequently by the repeated investigations of Sir B. Brodie.

264. It has been just stated, that after a poison has found its way into the circulation, it expends its virulence upon some particular organ. In some cases this is much more striking than in others. The preparations of *Baryta* and of *Antimony* attack the heart, and occasion death by syncope. *Arsenic* is less definite in its action; it influences both the brain and the heart, but with different degrees of force in different cases, so that it is often difficult to ascertain which of these organs is the first to fail in its functions. *Hydrocyanic Acid* destroys life by its action upon the nervous system, whose energies it would seem to extinguish without ostensible injury to any particular organ; and in all those animals which were killed by it in the experiments of *Orfila*, *Brodie*, and others, the heart was found acting regularly, and circulating dark-coloured blood; and in some cases, this phenomenon was visible for many minutes after the animal was in other respects apparently dead.

265. Some substances would seem to direct their powers to various parts of the alimentary canal; and the appearances so produced might be mistaken for the effects of the local action of the poison, had they not been clearly proved by experiment to have arisen from an application addressed through the medium of the circulation; thus is inflammation of the *primæ viæ* induced by the contact of arsenic with an external surface of the body.

265. The *Third Class* of my arrangement includes those poisons which enter the circulation, and, through that medium, expend their influence upon the spinal marrow, without *directly* involving the functions of the brain. *M. Majendie*, in the year 1809, submitted to the first class of the French Insti-

tute a series of experiments which had conducted him to the extraordinary result above stated. He found that an entire class of vegetables (the *bitter Strychnus*) possesses this singular property.

266. The *Fourth Class* comprehends all those substances which destroy life by a local action upon the alimentary canal; not by any impression upon their nerves, but by simply inducing a fatal lesion in the membranes, and generally entering into combination with their substance, the consequence of their chemical affinities being more powerful than the vitality of the organ,* as will be presently shown under the head of ESCHAROTICS.

267. Through one or more of the above modes of operation, all poisons may be said to produce their fatal effects. In some cases a poisonous substance will be found to act in several

* Professor Liebig generalizes this fact so far as to furnish a theory for explaining the operation of the inorganic poisons that are absorbed. "It is well known," he observes, "that corrosive sublimate and arsenious acid possess, in an eminent degree, the property of entering into combination with all parts of animal and vegetable bodies, rendering them at the same time insusceptible of decay or putrefaction. It is further known that those parts of a body which come in contact with those substances during poisoning, and which therefore enter into combination with them, do not afterwards putrefy; so that there can be no doubt regarding the cause of their poisonous qualities. It is obvious that if such substances are not prevented by the vital principle from entering into combination with the component parts of the body, and consequently from rendering them incapable of undergoing changes, they must deprive the organs of the principal property which appertains to their vital condition, viz. that of suffering and effecting transformations; or, in other words, organic life must be destroyed. Hence," he continues, "we may fix with tolerable accuracy the limit at which such bodies cease to act as poisons. For since their combination with organic matters must be regulated by chemical laws, death will inevitably result, when the organ in contact with the poison finds sufficient of it to unite with atom for atom; whilst, if the poison is present in smaller quantity, a part of the organ will retain its vital functions." He then proceeds to show, by an examination of the atomic or combining weights of these bodies, what very small quantities of arsenious acid, or corrosive sublimate, are requisite to produce deadly effects.

different ways; thus, the *Nightshade* is evidently absorbed, carried into the circulation, and is enabled, through that medium, to act upon the brain, at the same time it exerts a local action upon the stomach, although less violent than that occasioned by the acrid poisons; it moreover would appear, upon some occasions, to act directly through the medium of the nerves, like those substances which have been received in our first class, or else, how shall we explain the fact of the pupil of the eye becoming permanently dilated by the contact of the *Belladonna* with the tunica conjunctiva? It would appear, therefore, that this plant unites within itself all the three great modes of action, upon which I have just attempted to establish a physiological arrangement of poisons. So again, *Corrosive Sublimate*, although placed in the fourth division, as being a substance which destroys by inflicting local mischief, is nevertheless capable of being absorbed. Oxalic acid falls under the same category. The embarrassments, however, which might be supposed to arise from this double mode of operation, are of less practical importance than may be supposed. It is to the *primary* operation of a poison to which we are to direct our attention; the subsequent effects are less important, inasmuch as they are more capable of being controlled.

Having thus offered a summary of our present views respecting the physiological action of poisons, we are prepared to lay down a general plan of treatment, which, it will be seen, can only be successful when conducted on principles strictly conformable with the just notions which the preceding experiments have so satisfactorily established.

268. Where a poisonous substance has, either through accident or design, found its way into the alimentary canal, three important indications are, if possible, to be fulfilled; and under these heads I shall offer such observations as may serve to instruct the practitioner in the philosophy of the general treatment, reserving the details to be observed in that of each poison, for more particular notice. The indications to which I allude are the following.

1. *The immediate ejectment of the poison from the body, by the prompt operations of vomiting by emetics, and by the action of the stomach-pump; and finally by purgatives.*

269. Whatever may be the nature of the poison swallowed, common sense at once points out the necessity of ejecting it as speedily as possible from the stomach; and upon the promptness with which this is effected the safety of the patient will generally depend; for the dangerous effects of all such substances advance in a very increasing ratio with the time they remain in contact with a living surface. A question may arise, whether in some cases it might not be judicious to attempt, in the first instance, the neutralization or decomposition of the poison. Where a mineral acid, or a caustic alkali, has been taken, there can be no doubt that we should, as soon as possible, attempt to neutralize its effects, for even before an emetic could be brought to act, the membrane of the stomach might be fatally corroded, but this should be followed as speedily as possible by some expedient to relieve the stomach from its contents; vomiting may be effected by thrusting the finger down the throat, or by irritating the internal fauces with a feather, until other means can be procured. In cases in which *oxalic acid* has been swallowed, chalk should be given in the first instance, but we should avoid the alkalies, as they would form a soluble salt which, by absorption, would prove poisonous.

270. If time be given for the selection of an emetic, there can be no doubt that science will readily suggest that which is most appropriate to the case. As a general rule, vegetable emetics should be given in cases of metallic poisoning, and metallic emetics in cases of vegetable poisoning; this rule, at least, has the merit of being safe in the hands of those who are not well acquainted with the changes which may take place between the poison and the antidote. No one the least skilled in chemistry, for instance, would give

the *Sulphate of Copper* in cases where a caustic alkali has been taken; nor would he administer it in a case of poisoning by arsenic, for the *Arsenite of Copper* is soluble in the fluids of the stomach. *Ipecacuanha*, and the *Potassio-tartrate of Antimony*, should be preferred on such occasions. In vegetable poisoning the *Sulphates of Zinc and Copper* have the advantage of acting, without the necessity of much dilution;* a circumstance of no small importance in the treatment of poisons that act by being absorbed: in the next place, they are extremely expeditious, a dose of fifteen or twenty grains producing a very speedy effect, and without exciting that previous stage of nausea which so frequently characterises other emetics, and which occasions a state of the vascular system highly favourable to the functions of absorption, as I have before explained. (108).

271. The practice of emptying the stomach by means of a syringe, (*a stomach-pump*,) as originally proposed by Boerhaave, has within the last twenty years been revived, and is now universally employed.† It must be considered as a most important and invaluable present from the mechanist to the physician. It, however, deserves notice that, in many instances, as in poisoning by corrosives, there is a great advantage in allowing the stomach to discharge its contents by its own efforts, because the evacuation in such a case is much more complete. Without any wish to undervalue so important an auxiliary, I do not think it ought to supersede the employment of emetics. After all has been ejected which the operations of art can effect, we are to proceed, without delay, to the fulfilment of the second great indication, viz.—

* Dry Vomit of Marriott. This once celebrated emetic, called *dry*, from its having been exhibited without dilution, consisted of equal portions of *Potassio-tartrate of Antimony*, and *Sulphate of Copper*.

† When the stomach-pump is not in readiness, Mr. Bryce of Edinburgh has proposed the substitution of a long tube, with a bladder attached to one of its open extremities. After the stomach has been filled with warm water from the bladder, the tube is to be turned down, so as to act upon the contents of the stomach as a syphon.—*Christison.*

2. *The decomposition of any remaining portion, and the adoption of measures best calculated to obviate its absorption.*

272. Where the substance has been introduced in a solid form, as, for instance, in the case of powdered arsenious acid, or in that of opium, should any fear arise from its absorption, we ought to be extremely cautious how we favour its solution; while, should it have been in a liquid state, our object must be to render its active portion insoluble; this problem involves a series of questions which are wholly *chemical.* In order to prevent or retard absorption, we must to a great degree rely upon those means which physiology has suggested. (108.) In cases of corrosive poisons that act *locally*, copious dilution will be serviceable; but we ought to be well satisfied that no ulterior evil can arise from the absorption of the substance. Nothing, therefore, can be less true as an aphorism, nor more dangerous as a precept, than the unqualified assertion of Boerhaave, "*Aqua omnia venena enervat, quæ cum aqua misceri possunt.*" (Prælect. in Instut. t. vi., p. 289.) *Alkaline* solutions, and *Magnesia*, in cases of the ingestion of arsenic, accelerate its fatal effects, by promoting its solution; whereas *Lime* has an opposite tendency, in consequence of the insolubility of the *Arsenite* of that earth. This view of the subject will explain the slow and comparative inertness of the pure earth *Baryta*, while, if combined with *Hydrochloric acid*, it becomes a violent poison; but the soluble *chloride* thus formed may be disarmed of its virulence by the administration of any soluble *sulphate*, by which it is decomposed, and its base converted into an insoluble salt. In cases where *Verdigris* has been swallowed, the administration of vinegar greatly increases its virulence, as M. Drouard has ascertained, by converting that substance into a soluble *acetate* of copper. On the other hand, the salts of copper are reduced by sugar and honey either into metallic copper, or its oxide, neither of which is poisonous; so that sugar in such a case is a true antidote.

Orfila has fully established the fact of *Albumen** being a counter-poison to *Corrosive Sublimate;* and this is brought about by the very same affinities that render the mercurial salt so destructive; the *bi-chloride* is thus converted into the *chloride*, which forms with the albumen an insoluble and harmless compound. With equal success has the *Hydrated Sesqui-oxide of Iron*† been administered as an antidote to arsenic. It was first suggested by Bunsen and Berthold of Gottingen; and Dr. Puckett of Berlin is said to have restored several patients labouring under the effect of poison, after the lapse even of six hours after its ingestion. In analysing the matter rejected from the stomach, it was ascertained that the *oxide* had been changed into the *arsenite* of iron. It is said that its dose ought to be at least as twelve to one of the arsenic; and it has been found to answer better when given moist, in a state of *Magma.*

273. It has been often questioned how far the exhibition of *vinegar*, *lemonade*, and different acid potations, may be beneficial in poisoning by opium. It is very evident, that, if any quantity of the substance of opium remain in the *primæ viæ*, acid drinks will, by favouring its solution and absorption, accelerate its fatal effects.‡ Chardin, in his travels through Persia, informs us that when a Persian finds himself in a distressed situation he has recourse to a piece of opium, as large as the thumb, and that immediately afterwards he drinks a glassful of vinegar; by which he is thrown into a fit of laughter, terminating in convulsions and death.

* Vegetable gluten, as existing in wheat flour, is said to answer as well as albumen.

† Lately introduced into the Edinburgh Pharmacopœia, under the title of "*Ferrugo.*"

‡ The truth of this statement has been very satisfactorily established by the experiments of Orfila, (Toxicologie générale considérée sous les Rapports de la Physiologie, de la Pathologie, et de la Médicine légale,) as well as by several that have been performed in this country.

Tortosa (Istituzioni di Med. For.) has remarked that opium may act mortally without losing much of its weight in the stomach. I should question the truth of this assertion.

274. From the above remarks, the practitioner will be enabled to form a fair judgment as to the value of antidotes; while he regards them with all the attention they may deserve, he will be careful not to allow an overweening confidence in their powers to divert him from his first great object, that of ejecting as early as possible the offending substance. But in our measures to effect this, we may avail ourselves of the chemical antidotes as auxiliaries. Vomiting may be promoted by the ingestion of liquids holding the appropriate counter-poison in solution, or suspension; a practice which offers the double advantage of accelerating the elimination of the poison, and, at the same time, of decomposing any that may remain; thus, in poisoning by *corrosive sublimate*, water holding the white of egg in solution, or flour and water, may be used, either as a diluent, or for washing out the stomach with the pump; with equal propriety, sugared water may be so employed in cases where *Verdigris* has been swallowed; *Chloride of Sodium*, should the poison have been *Nitrate of Silver;* and *Sulphate of Magnesia*, should *Acetate of Lead* be the object of our treatment. Where an emetic salt like that of antimony has been taken, copious dilution with tepid water will, in general, so provoke vomiting, as to render it its own antidote; but it may be useful to know that the *Infusion of Galls*, and, according to Berthollet, the *Decoction of Bark*, at the temperature of from 30° to 40° Fah., have the power of decomposing it.

3. *To anticipate the occurrence of the Consecutive Phenomena, and to combat them by appropriate treatment.*

275. Although we have denied the existence of what have been termed "Slow Poisons," according to the acceptation of the term, (248,) yet we are bound to admit that, after the expulsion or total decomposition of the poison, a series of symptoms may arise which may possibly, at some remote period, terminate fatally; that is to say, the action of the

poison may have inflicted such organic mischief as may lay a foundation for future disease. It therefore becomes an object of anxiety to anticipate such an event, and although the treatment must be conducted on the general principles of pathology, we ought never to lose sight of the original cause of the malady. Inflammation must, of course, be opposed by bleeding; but in adopting this practice, in cases where the poison acts by being absorbed, we ought to be well satisfied that it is entirely removed from the alimentary canal, since venesection, as already stated, (108,) proves one of the most powerful means of exciting absorption; and yet in some works on Toxicology, we find blood-letting recommended, as a safe precaution, to be used against the inflammatory action produced by arsenic. In cases where the brain is stupified, the symptoms must be combated by vegetable acids, and the affusion of cold water upon the surface of the body; and should it be in a state of preternatural excitement, recourse may be had to sedatives. In short, no general rule can be laid down for the treatment of consecutive poisoning; the practitioner must adjust his tackle with reference to the direction and strength of the storm. In the exhibition of vegetable acids, however, for the purpose of removing the stupor consequent upon poisoning by opium, the practitioner has already received a caution, (273,) which it will be well for him to keep in his remembrance. Should the poison have been wholly ejected, then the anti-narcotic influence of a vegetable acid may remove the stupor and delirium, and thus realize the expectations which Virgil has so poetically raised.

> "Media fert tristes succos tardumque saporem
> Felicis Mali; quo non præsentius ullum
> (Pocula si quando sævæ infecere novercæ
> Miscueruntque herbas, et non innoxia verba)
> Auxilium venit, ac membris agit atra venena."

> "Nor be the Citron, Media's boast, unsung,
> Though harsh the juice, and ling'ring on the tongue.

When the drugg'd bowl mid witching curses brew'd
Wastes the pale youth by step-dame hate pursued,
Its powerful aid unbinds the mutter'd spell,
And frees the victim from the draught of hell."

276. In conclusion, it is important that the practitioner should be well acquainted with the means to be promptly used in cases where a poison has been EXTERNALLY introduced, as, for instance, through a wound, or an abraded surface; and which generally acts, when so applied, with great quickness and energy.

This problem resolves itself into two distinct propositions, viz.

1. *How the poison may be removed, or neutralised.*

277. The poisons which the practitioner will be called upon to encounter upon these occasions will generally belong to the organic kingdoms. The cases in which arsenic or corrosive sublimate are applied under such circumstances must be extremely rare. Should the surface with which the poison comes into contact bleed very freely, it may be washed away, but little dependence can be placed upon this occurrence as a preventive; nor does any chemical application, as far as we know, offer any security against the venomous bites of serpents, the hydrophobic virus, or that poison which is introduced into the system through wounds received in dissection, and "to which accidents," observes Mr. Travers, "veterinary students, farriers, slaughterers, butchers, sausage-makers, and cooks, are in common with anatomists especially exposed." *

It has been supposed that the application of *Ammonia* to a part stung by an insect produces relief by a chemical action, since the irritating fluid, according to Tiedemann, is of an

* Travers's "*Inquiry concerning Constitutional Irritation*," 1827, and also "*A Further Inquiry*," 1835; works of deservedly high authority, to which I refer the practitioner for numerous cases in illustration of this subject.

acid nature; but in the living parts there is always a combination of effects following a chemical agent; and it is questionable whether the *Ammonia* may not produce its beneficial effects by stimulating the affected part. *Saliva* is unquestionably effectual in relieving the pain from the sting of a bee, but its *modus operandi*, as far as I know, has never received an explanation. It is also said that the juice of the green leaves of tobacco will allay the stinging from nettles. *Escharotics* can scarcely be regarded as *chemical* antidotes, since they act by destroying the vitality of the part in contact with the poison; and may, therefore, be more properly classed under the next division, viz.—

2. *The means to be employed for preventing the ingress of the poison into the circulation.*

278. In the application of caustic, experience has put us in possession of one very important fact, that whenever it is employed, it should be applied at the moment the wound is inflicted; after inflammation has commenced, it will only augment the mischief. The immediate application of a tight ligature upon the limb above the wounded part, will arrest the absorption of the poison, and allow time for the free excision of the part affected; this is the more necessary in the event of a bite from a venomous serpent, from the great rapidity with which its poison operates.* In the case of a wound inflicted by a rabid dog, experience has proved that the hydrophobic virus requires time to evolve its noxious principle, and that a careful excision of the bitten part, or the destruction of it by a powerful caustic, *at any period prior to*

* Dr. Stevens states that common salt is an antidote to the poison of the rattle-snake; when an Indian is bitten, he tells us, that he applies a ligature above the part, and scarifies the wound to the very bottom; after which he stuffs it with common salt; and he adds, that the wound soon heals without any ill effects upon the system. How much of the cure is justly indebted to the salt upon these occasions?

the appearance of symptoms, will be effectual; but this fact cannot sanction any delay on the part of the practitioner. After the limb has been duly compressed by a ligature, the application of a cupping-glass, with a view to the abstraction of the blood concentrated below it, offers a very rational plan of treatment.

279. Before concluding this chapter, it might be expected that something should be said upon the subject of SEPTIC or PUTREFIANT poisons; but as the investigation necessarily involves many questions connected with the theory of putrefaction, and as the late researches of Professor Liebig have opened some novel and highly important views with regard to it, and which may lead to an explanation of the generation and *modus operandi* of certain morbid poisons, I shall include under the head of ANTISEPTICS, such remarks as might otherwise have more properly fallen under the consideration of ANTIDOTES.

ANTISEPTICS.

280. Substances which are capable of opposing or counteracting such chemical changes as may occur in organic matter, upon the decline or extinction of the powers of life.

281. In accordance with the views of the humoral pathologist, Dr. Cullen arranged *Antiseptics* under the class of remedies which were supposed to alter the condition of the *fluids* of the body; and since the specific virtues of these substances had been deduced from their acknowledged influence in checking the putrefaction of dead animal matter, Sir John Pringle constructed, from such data, a table exhibiting the relative antiseptic powers of different salts.

282. Modern physiologists, however, have rejected the belief in the occurrence of putrescency in the living body,

maintaining that chemical agency, to the extent of decomposing the solids or fluids, is wholly incompatible with the powers of life. This opinion, although, without doubt, based upon truth, and in strict accordance with the acknowledged attributes of the living principle, still requires to be carefully reviewed and probably modified. Much discrepancy of opinion would appear to turn upon the vagueness of the definition. The term *putrefaction*, with reference to the question before us, has been far too loosely and indiscriminately applied. According to popular acceptation, we understand by it a succession of chemical changes, characterised by a more or less nauseous and offensive smell, by which an organic body, after passing through various stages of softening and attenuation, is ultimately exhaled, leaving only a small and fixed residue of earthy and saline matter. But let it be remembered that, between the incipient motions and those ulterior phenomena to which we have alluded, a number of intermediate changes occur, each of which must at once become final, the instant the chemical and vital affinities are brought to a balance. It is therefore to the early links in the chain of decomposition that the attention of the pathologist is to be directed.

283. Although putrefaction, in its extreme sense, can only take place after the extinction of life, it is equally obvious that, on the decline of vital power, a chemical movement may commence, and continue to advance, until its further progress is arrested by its antagonist force, or, in other words, until the chemical and vital powers attain an equilibrium. Instances have been already adduced to show that, upon the decline of vital power, chemical re-actions will take place; (208, *and note thereon ;*) and the history of disease would furnish numerous examples, in which vitality appears unequal to the struggle against the septic tendency. In the varieties of gangrene and mortification we shall find ample illustrations of all that has been advanced. Let us examine what takes place in a frost-bitten limb; the vitality of the part is ex-

hausted by the continued demand made upon the nervous energy to sustain its temperature; in this devitalized state, if it be suddenly exposed to heat, the chemical forces are brought into play, and the limb becomes immediately gangrenous; but if its temperature be very gradually raised, we give time to the living powers to restore the vitality of the part before any decomposition can take place, for in the absence of heat and moisture, chemical forces are in abeyance. We see, therefore, the propriety of the practice of plunging a frozen limb into ice water, and afterwards of gradually raising its temperature.

284. In those diseases, to which the epithet of *Putrid* was formerly given, such as certain fevers, sea-scurvy, &c., the putrescent odour of the discharge, as well as the very rapid manner in which the body, after death, runs through the extreme stages of putrefaction, renders it probable that some of the preliminary decompositions may have commenced previous to the extinction of life. In all our discussions upon this question, it seems desirable that we should adopt some term to express the ascendency of chemical forces, consequent upon the decadence or failure of vital power; the term *Hyper-chemisis* might denote such a condition, reserving that of *Putrefaction* to express the ulterior stages and consummation of the process.

285. By whatever name, however, we may designate such a state, experience has as fully established the fact of its existence, as it has shown the value of certain remedies for its correction. In cases of putrescent wounds and ulcers, poultices and lotions may act *chemically* by decomposing the noxious matter generated, whose presence must promote the septic condition, and advance its progress, (283,) such are the yeast poultice, powdered charcoal, and, above all, a solution of *Chlorinated Soda;* this latter substance, from its strong affinity for hydrogen, decomposes all the compound gases into which it enters, especially that of ammonia, which, as we know, plays an important part on these occasions.

There are also applications which act, *vitally*, by stimulating the nerves and vessels of the part, and thus arousing the living powers to a more active contest. As to the remedies for correcting a general state of *Hyper-chemisis*, they must be regarded as vital rather than chemical agents; such are Lemon-juice in scurvy, *Bark* and the *Mineral acids*, *Serpentaria*, *pure air*, *invigorating diet*, *steel*, &c.

286. In a recent work by Professor Liebig, to which I have frequently referred, we are presented with views not only applicable to the question under discussion, but well calculated to extend our knowledge with regard to the *modus operandi* of contagious matter, and its reproduction in the living body. I have already explained his important application of the dynamic law of Laplace to chemical action, (207,) *viz.* that "*a body, the atoms of which are in the act of transformation,* (*to which he has given the name of the* EXCITER,) *may impart its peculiar condition to compounds with which it may happen to communicate.*

287. The influence of a *ferment* in exciting an action between the molecules of certain bodies, so as to give origin to a product similar to itself, has been long recognised in the phenomena of fermentation; and it is not a little singular that the facts should never before have been so generalised, as to have established a law including various analogous forms of combination and decomposition. This, however, was reserved for the genius of Liebig; and I cannot better explain the manner in which this law is supposed to operate, in exciting and promoting a septic condition, than by adducing some of the more striking examples by which he has proposed to illustrate it. It is a well-known fact that, if blood, cerebral substance, gall, pus, or any other matter in a state of putrefaction, be placed upon fresh wounds, the vital powers will become depressed, and the blood and tissues of the body will enter upon a corresponding series of changes, and, should the reaction of the living principle be inadequate to the conflict, vomit-

ing and other symptoms will ensue, and death be the ultimate consequence.* The Wurtemburgh sausages, the occasional poisonous nature of which has excited such general interest and inquiry, evidently fall under this category. "They consist of blood, liver, bacon, brains, milk, meal, and bread, together with salt and spices; this mixture is put into bladders or intestines, and after having been boiled, is smoked. When well prepared, they may be kept for months, and will furnish a nourishing and savoury food; but when the spices and salt are deficient, and particularly when they are smoked too late, or not sufficiently, they undergo a peculiar kind of putrefaction, which begins at the centre of the sausage. Without any appreciable escape of gaseous matter, they become paler in colour, and more soft and greasy; and they are found to contain free *Lactic acid* or *Lactate of Ammonia*, products which are universally formed during the putrefaction of animal and vegetable matter. Experiments have been instituted in order, if possible, to detect the presence of some specific poisonous matter, but in vain; boiling water, and alcohol, however, have been found to destroy the poisonous properties of such sausages, without themselves acquiring similar properties; and for this obvious reason, that a state of action or power cannot be preserved in such liquids. In fact, they exercise an action upon the organism, in consequence of the stomach and other parts with which they come in contact not having the power to arrest or modify that decomposition; and thus, while still possessing their whole power, by entering the blood they impart their peculiar action to the constituents of that fluid, and all the substances in the body are induced to undergo a modified putrefaction; the secretions become of-

* *Orfila* has illustrated this subject by numerous cases and experiments. *Professor Fodéré* relates that at the siege of Mantua, a number of persons who were obliged to feed on horseflesh half putrid, had the dry gangrene and the scurvy. In *Crantz's* history of Greenland we read of thirty-two persons, at a military station called Kangek, having died shortly after a repast upon the putrid brains of the Walrus.

fensive, there is a gradual wasting of the muscular fibres, and after death, nothing remains except those textures which are incapable of putrefying under the conditions afforded by the body." It must surely be admitted that we have in this case an undeniable example of a SEPTIC POISON.*

In hospital gangrene, again, where the slightest wound assumes all the characters of a putrid sore, and which has been so graphically described by Dr. Hennen, and Riberi of Turin, there can be no doubt that a *septic* poison is generated by the action of an impure atmosphere upon a part of low vitality.

288. The theory of Liebig may also afford some explanation of the hitherto mysterious fact connected with the animal poison received in dissection, viz. that the greater proportion of cases have their origin from the dissection of bodies *recently dead.* " Of all the examples," says Mr. Travers, " which I have selected, it is remarkable that the subjects were recent; not one had been buried; some were yet warm;" it is clear, therefore, that the peculiar state, upon which the deleterious action depended, was confined to the earlier stages of decomposition. " If," observes Mr. Travers, " at the moment of expiring vital influence, or of deanimalization, new combinations give birth to a specific matter of contagion, it is to be presumed that the ultimate state of dissolution and decay, which we call putrefaction, so alters its quality as to neutralize and render it inert." According to the views of Liebig, we should explain the same fact by assuming a peculiar active condition, or transposition of the atoms, which belong only to the earlier stages of decomposition, impressing a kindred action upon the living texture with which they come into contact.

289. To tell a common observer that a piece of meat, or any portion of animal matter, will not, *sua sponte*, pass into a state of

* May not the hitherto mysterious subject of the poison of fish receive some elucidation from this train of research? See *Medical Jurisprudence*, vol. ii. p. 449.

putrefaction, would in his opinion be to deny the evidence of his senses, and to contradict the unanimous voice of experience. It is nevertheless perfectly true that, unless some external impulse disturb the statical equilibrium of its elements, so as to determine the commencement of decomposition, the corpuscles will passively retain their state of union; but under ordinary circumstances such impulses, although present, are not obvious, and are therefore liable to escape our notice. The theory of Antiseptics, therefore, includes two propositions; —*first*, the means by which we may withdraw from the sphere of action all such agents as may be capable of imparting to the quiescent molecules the necessary impulse;—*secondly*, those by which the molecules may be rendered indifferent to such impulses, and therefore preserved from change. Let us consider each of them.

1. *Putrefaction prevented by removing the influences necessary to its commencement.*

290. These may be said to be the presence of a certain portion of water, the access of air, a moderate degree of heat, and the contact of some matter, however small in quantity, in which putrefaction has already commenced, or, in the language of Liebig, the atoms of which are in the act of transformation.

291. That putrefaction is prevented by the abstraction of moisture from animal matter, or what is equivalent to it, by such a reduction of temperature as must render it passive, is a fact sufficiently obvious;* but the way in which its presence operates in promoting it, may require some explanation. It acts, then, not only as a medium for affording that facility of motion between the elementary atoms, without which their transposition could not proceed, but its decomposition fur-

* The bodies of the Spaniards have lain unchanged on the icy summits of the Cordilleras from the time of the first conquest of Peru. While a body buried in the sultry sands of the Delta is equally protected from putrefaction by the evaporation of its water.

nishes hydrogen to carry off the nitrogen of the animal matter in the form of ammonia, and oxygen to form an union with the carbon, which escapes as carbonic acid. The presence of air, although necessary for initiating the process, does not appear to be essential to its progress.* For the reason above stated, a certain degree of heat is absolutely necessary, although an excess of it, by reducing the animal matter to dryness, will arrest its putrefaction. The contact of the smallest portion of animal matter, in a putrescent state, with fresh meat, will rapidly induce the latter to pass into the same condition. This is well known to all those whose business it is to preserve animal food.

292. If over fresh flesh salt be strewed, it will be found in the course of some hours swimming in brine, although not a drop of water had been added, and hence its antiseptic property; for by abstracting so much water from the animal textures, a sufficient quantity is not left to enable them to undergo the putrefactive process. Alcohol exerts a similar action.

2. *Putrefaction may be prevented by substances that are capable of forming a chemical union with the organic matter, by which it is rendered indifferent to change.*

293. Although Chloride of Sodium no doubt acts by abstracting water, as above stated, it is highly probable that it also exerts some chemical action upon the animal texture; so that the salting or pickling of meat is something more than the abstraction of water. In proof of this, we may relate the experiment of M. Eller, who having boiled water containing one-twentieth of its weight of common salt in a brass kettle, detected in it traces of copper; but, if instead of heating a simple

* Animal food has been preserved sweet for many years, by heating it to the temperature of boiling water in vessels from which the air is completely excluded.

solution of salt in a copper vessel, he introduced it in combination with beef, bacon, or fish, the resulting fluid did not contain an atom of copper; this fact has been corroborated by Orfila. Solutions of *Corrosive Sublimate*, and several other metallic salts, prevent putrefaction by combining with the albuminous principle, and thus rendering it incapable of change. The same may be said of *Creosote*, which when placed in contact with albumen coagulates it immediately; and since pyroligneous acid and tar-water produce the same effect, there can be no doubt that *Creosote* is the antiseptic principle of these bodies, as well as that of wood-smoke. It is not so easy to explain the operation of other well-known antiseptics, as *hydro-chloric acid*,* *sugar*, *honey*,† *spices*;‡ the former of these bodies may exert a chemical action upon the nascent products of decomposition.

294. Since the effluvia given off from organic matter in a state of decomposition, especially if exhaled from diseased bodies, are highly deleterious to animal life; it becomes a matter of great importance to purify an atmosphere so contaminated, the consideration of which introduces us to one of the most interesting branches of the present inquiry.

295. It would appear that all living bodies, when crowded together, generate a peculiar matter of a highly destructive nature. No species of animal can congregate in ill-ventilated apartments with impunity. Under such circumstances the

* Sir W. Fordyce relates that a "dry-salter" acquired a large fortune from possessing a secret that had enabled him to send out provisions to India in a better state of preservation than any others of the trade; his secret consisted in adding a small quantity of muriatic acid to the contents of each cask.

† *Honey* was employed for preserving the bodies of the Spartan kings, who fell at a distance, in order that they might be carried home. The Veddahs, a savage race inhabiting the wilds of Ceylon, even in that hot climate effectually preserve their venison in honey.

‡ The value of spices may in some measure depend upon their power to keep away insects.

horse becomes infected with Glanders,* fowls with the *Pip* or *Pep*, the dog with the distemper, and sheep, if too thickly folded, with a disease peculiar to them. In the history of the "*Hospital Gangrene*," we have the most satisfactory evidence of the influence of a pestilential atmosphere generated by the congregation of the sick; and in the account of that disease, which occurred in the hospital of San Giovanni in Turin, in the years 1817—1820, Dr. Riberi states a fact which shows how the severity of the disease varied with the relative impurity of the air; for he tells us that in those patients who were fortunate enough to lie in the best ventilated parts of the sick wards, the sphacelating was exchanged for an erysipelatous affection.

296. The first and most important remedy for such evils is free ventilation; and it is a question how far many of those fumigations, which have been supposed to exert a specific influence over the poisonous effluvia, may not have been indebted for their salutary effects to the production of a current of air. Not that we should undervalue certain disinfectants, to which theory as well as experience have assigned an undisputed value. *Hydro-chloric* and *Nitrous acid* gases were long regarded as highly efficacious, and it is probable that they may act beneficially by destroying the peculiar organic products, to whose presence the malign influence may be attributed. These disinfectants, however, have been in a great measure superseded by *Chlorine*, which is regarded as a much more active agent. It at once decomposes *Ammoniacal* and *Hydro-sulphuric gases*, which there is reason to believe are developed on these occasions; and the readiness with which it at once removes every noisome smell must

* In the expedition to Quiberon in 1795, several transports crowded with horses had their hatches shut for a considerable time in a storm, by which some of them were suffocated, and amongst the survivors the contagious disease of *Glanders* was engendered. It is worthy of remark, that diseases engendered by congregation are apt to become contagious.

necessarily create a strong opinion in its favour. In the midst of the dreadful contagion which raged in Spain, it is said that the inhabitants always escaped in those houses in which fumigation of Chlorine had been used. In our own country, the penitentiary has undergone fumigation by this gas, under the superintendence of Mr. Faraday; and it is an interesting fact that during the epidemic fever which raged over Ireland from 1816 to 1819, the persons employed in the chemical manufactory at Belfast, which contained in its atmosphere a considerable portion of *Chlorine*, were wholly exempt.*

* The recent experiments of Professor Daniel upon the waters of the estuaries and western sea coasts of Africa, are full of interest to the medical philosopher. (*Philosophical Magazine, Third Series, No.* 121, *for July* 1841.) He was induced to this investigation by the fact of the very rapid destruction of the copper sheathing of ships on the coast of Africa; and his inquiry embraced an extent of fifteen or sixteen degrees of latitude. The result was the discovery of sulphuretted hydrogen in these waters to an amount, in some places, exceeding that of some of the most celebrated sulphur springs in the world. Here, then, he detected an agent quite sufficient to account for the rapid corrosion of the copper. But the discovery is far more important in a medical point of view. He asks whether the existence of this deleterious gas in the atmosphere, which must necessarily accompany its solution in the waters, may not be connected with that awful miasma which has hitherto proved so fatal to the explorers and settlers of the deadly shores of Africa; and he has brought together a mass of evidence highly corroborative of such an opinion. He has shown by numerous experiments that decaying organic matter has the property of decomposing sulphuric salts, and of developing sulphuretted hydrogen, and he accounts for the presence of this gas on the African coast by the mutual reaction of the immense quantities of vegetable matters, which must be brought down by the intertropical rivers, and the *Sulphates* of the sea water. It has been long remarked that the malarious districts in all countries, not excepting our own, on the coast of Essex, are those in which there is a conflux of land and sea water. In consequence of this report, the Admiralty gave directions for affording to a ship about to sail to Africa the means of producing and applying the antidote—Chlorine. It may be a question worthy of investigation by the veterinarian, how far the presence of *Sulphuretted Hydrogen* in stables may be the cause of certain diseases in the horses that occupy them. We know that the fatal asphyxia, which has often occurred to persons engaged in emptying privies, is the effect of this poisonous gas.

297. The method employed in the penitentiary by Mr. Faraday, for the evolution of chlorine, who with chemical accuracy adjusted the proportions of the different ingredients, was by acting upon one part of *Common Salt*, and one part of *Oxide of Manganese*, by two parts of *Sulphuric Acid*, previously diluted by one part (by weight) of water. It appears, however, that any such method of rapidly evolving chlorine is far less efficacious, as well as less convenient, than that which is effected by the slower and more steady action of the solution of *Chloride of Lime*, commonly called LABARRACQUE'S DISINFECTING FLUID. Under the title of *Calx Chlorinata*, this chloride has been introduced into the Pharmacopœia, and a formula is given for its preparation.*

298. In treating of disinfectants, we have hitherto only alluded to such as exist, or are developed in an aerial form, and are consequently well adapted, by diffusing themselves through the atmosphere, to neutralize or decompose the noxious effluvia; but there are solid bodies which may be found useful in decomposing, or combining with noxious effluvia suspended or dissolved in the air; such, for instance, is quick-lime, which, from its great affinity for carbonic acid, will be found efficacious in removing from cellars, wells, and other confined places, the fixed air which may have accumulated, and from which so many lives have been lost. There are likewise particular bodies, which, in a mechanical state of division, would appear to possess the faculty of absorbing from the atmosphere certain deleterious principles. By submitting sand to a red heat, so as to drive off any adhering matter, and exposing it to a tainted atmosphere, such as that in the ward of an hospital, or crowded apartment, we shall find that, on the application of a spirit lamp, it will yield ammoniacal fumes. Hence it must have absorbed effluvia during its exposure. If the inference to be drawn from this fact be correct, it will show the importance of constantly re-

* For an explanation of its true composition, see Phillips's translation of the Pharmacopœia.

newing the sand, so often strewed in infected apartments, and will afford some explanation of the benefit derived from the application of fresh whitewash.

299. Various aromatic and acetous preparations have at different times enjoyed the public confidence as prophylactics in contagious atmospheres, such as *Aromatic Vinegar*,* bags of *Camphor*, &c. I should, however, be disposed to regard them as only useful in giving confidence, and as being pleasant, by disguising smells.

ANTILITHICS, AND LITHONTHRYPTICS.

300. ANTILITHICS† are remedies which are regarded as possessing the power of preventing those mechanical deposits

* The repute of this prophylactic is popularly believed to have arisen from the confession of four thieves who, during the plague of Marseilles, plundered the dead bodies with perfect security, and upon being arrested, stated, on the condition of having their lives spared, that the use of *Aromatic Vinegar* had preserved them from the infection. It is on this account sometimes called "*Le Vinaigre des quatre Voleurs.*" It was, however, in use long before the plague of Marseilles. We are informed that it was the constant custom of Cardinal Wolsey to carry in his hand an orange deprived of its contents, and filled with a sponge soaked in vinegar impregnated with various spices, in order to preserve himself from infection when passing through the crowds which his splendour or office attracted. The first plague raged in 1649, whereas Wolsey died in 1531. The French Codex has a preparation of this kind, consisting of an acetic infusion of various aromatic herbs and camphor, which is termed "*Acetum Aromaticum Alliatum*" seu "*Antisepticum*" vulgo "*des Quatre Voleurs.*" The German dispensatories abound with medicated vinegars, chiefly aimed against pestilential diseases in many of which Garlic is a principal ingredient. "AROMATIC VINEGAR," as commonly sold in this country, is an acetic solution of camphor, oils of cloves, lavender, and rosemary. The acetic acid employed, is about 145° of the acetometer, containing 68·5 per cent of real acid. A preparation of this kind may be extemporaneously made by putting a drachm of the *Acetate of Potass* into a phial, with a few drops of some fragrant oil, and ɱxx of sulphuric acid.

† From ἀντι, against, and λιθος, a stone.

from the urine, which give origin to calculous concretions. They may belong to the class of *vital*, as well as to that of *chemical* agents.

301. Lithonthryptics* are such as, by a *chemical* action, have been supposed capable of dissolving, or breaking down calculous concretions, whether lodged in the kidney or bladder.

302. Several elaborate works and monographs upon this important subject have been produced by authors as eminent for their medical as for their chemical knowledge.† I apprehend, however, that a general and condensed view of the practical parts of the inquiry will not be the less acceptable to the practitioner; to him facts capable of useful application in the treatment of such diseases have alone any true value; the author of an original work upon so extensive a branch of chemical and vital pathology, must necessarily sustain his propositions by argument and illustration, and expose fallacy by acute and laboured criticism; in consequence of which the really useful facts, upon which the treatment must turn, are unavoidably mixed up with, and too often overlaid by, controversial disquisitions. Hence a condensed analysis of what we really know is no small boon to the young practitioner; and since the object of the present work is to afford him, in its greatest latitude, that kind of information which may enable him to construct with skill medicinal formulæ, I shall steadily keep in view such points in the inquiry as may show the necessity, and explain the operation, of a combination of remedies.

* From λιθος, and θρυπτω, to break.

† Amongst which may be enumerated the early papers in the Philosophical Transactions, by Dr. Wollaston, Mr. Brande, Dr. Pearson, Dr. Henry of Manchester, &c., and the works of Dr. Marcet and Dr. Prout, which well merit the attentive study of the medical practitioner. The lectures upon Calculous Diseases, by Sir B. Brodie, (*Medical Gazette*, vol. viii., *for the year* 1831,) so remarkable for the perspicuity of his theory, and the soundness of his practice, illustrated by cases drawn from the rich store of his own experience, are entitled to the highest regard of every physician and surgeon.

303. It has been frequently stated during the progress of this work, that certain substances, when internally administered, are capable of passing the barriers of digestion, of entering the current of the circulation, and, finally, of being again separated by the excretory vessels of the kidneys, and eliminated from the system through the medium of the urine. (35.) It cannot, therefore, be contended that the urinary deposits are placed beyond the sphere of direct medicinal influence; nor can any argument, founded upon an assumed incompatibility of chemical with vital action, be fairly maintained in this case, since the urinary deposit, as well as the urine itself,* may be justly considered as extraneous to the living body. In theory, therefore, the existence of such a class of remedies as Antilithics, or Lithonthryptics, cannot be disputed; but experience can alone determine the extent of their powers, and the circumstances under which they may be successfully administered.

304. Since an acquaintance with the chemical composition of healthy urine must constitute the basis of all our researches and reasoning upon its morbid deviations, the subject for our consideration necessarily resolves itself into the following heads:—

1*st*. *The composition of healthy urine.* 2*nd*. *The changes which its several principles undergo in the formation of deposits.* 3*rd*. *The conditions of the body under which such deposits take place.* 4*th*. *The remedies by which they may be prevented.* *And* 5*th*. *The means by which, when retained in the body, they may be removed.*

305. 1st. HEALTHY COMPOSITION OF URINE. Its general

* The kidneys have a more obtuse sensibility, and not such energetic activity as other glands possess: vital action is less concerned in the secretion they carry on, and their functions more easily fall under chemical and hydraulic explanations.—*Richerand.*

external characters need not be described. The quantity voided, and consequently its colour, is necessarily variable, depending upon the amount of liquids taken, the condition of the skin, and that of the other excretions, and the state of the atmosphere; but under the ordinary circumstances of health and habits, Dr. Prout considers that, in our climate, the average in twenty-four hours is from 30 oz. of *specific gravity* 1·025 in the summer, to 40 oz. of *specific gravity* 1·015 in winter. There is, however, a marked distinction between that which is voided after drinking and a moderate meal, and that secreted after the completion of the digestive process; to the former physiologists have assigned the name of *Urina Potus;* to the latter, and from which alone any correct estimate of its nature can be fairly deduced, that of *Urina Sanguinis.* It ought to slightly redden litmus paper, and on cooling it very frequently exhibits a slight mucous cloud. In composition, this fluid must be considered as the most heterogeneous and variable of all the animal secretions; the proportions of its different ingredients constantly changing, and often without even a reference to any unhealthy condition of the system. The following results, however, of an elaborate analysis by Berzelius may be received as furnishing its standard composition.

Animal Principles.	Water	933·00
	Urea	30·10
	Lithic Acid	1·00
	Pure Lactic Acid, Lactate of Ammonia, and Animal matters not separable from these; (the latter of which Berzelius regards as the *effete debris* of the body.)	17·14
	Mucus of the Bladder	32
Alkaline and Earthy Salts.	Sulphate of Potass	3·71
	——— of Soda	3·16
	Phosphate of Soda	2·94
	——— of Ammonia	1·65
	Muriate of Soda	4,45
	——— of Ammonia	1,50
	Earthy Phosphates with a trace of Fluate of Lime	1·00
	Silex	·03
		1000·00

306. We shall now proceed to examine the nature and habitudes of those leading principles which give a character to the urine, and are more immediately active in the production of its deposits.

307. *Urea.* In the earlier editions of this work, *Urea* was regarded as a principle peculiar to urine, and as the exclusive result of the action of the kidneys upon some constituent of the blood; but recent observations and experiments have proved that it pre-exists in the blood, and in certain renal diseases is retained by it in considerable quantities, while in health it is immediately removed by the kidneys, those organs, however, merely acting as outlets for its elimination. It was also long considered as the specific principle upon which the colour and other sensible qualities of the urine depended; but upon this point we have been set right by Berzelius, who has shown that the *Lactic Acid*, and the animal matters with which it is associated, are the bodies which more immediately impart to this fluid its characteristic odour. The characters of urea have been correctly defined by the experiments of Dr. Prout, while those of Wohler have proved it to be a *Cyanate of Ammonia*, and shown, moreover, that it may be artificially formed during the decomposition of the *Cyanate of Silver* by *Muriate of Ammonia*. According to Dr. Prout, urea is a crystallized body, leaving a sensation of coldness on the tongue, like nitre; its smell is faint and peculiar, but *not urinous*. It is neither sensibly acid nor alkaline; and although it unites with several acids, thus forming *the Nitrate*, *Oxalate* and *Lactate of Urea*, yet it does not neutralize them. In damp weather it is slightly deliquescent; at 250° it fuses into a colourless fluid, and at a higher temperature is decomposed into *Ammonia*, *Cyanate of Ammonia*, and dry solid *Cyanuric Acid*. Combined with the elements of water, it assumes the form of *Carbonate of Ammonia* (25, *note*).

308. *Lithic Acid.* With reference to urinary deposits, this is by far the most important principle in the urine. It was

formerly supposed to exist in a free or uncombined state:* but Dr. Prout has very satisfactorily shown that it is always in combination with ammonia in the natural state of the fluid, from which, however, it is separated by the weakest acid. Pour a portion of any acid into urine, and down goes a red precipitate, not very unlike cayenne pepper in appearance, which is pure *Lithic Acid.* Here is a case of simple affinity; the *Lithate of Ammonia* is decomposed, the ammonia combines with the precipitant, and the lithic acid is separated; upon which simple fact rests the whole theory of lithic acid deposits, and the treatment by which they are to be prevented. This acid, like urea, is rich in nitrogen, the former containing 46, the latter 30 per cent. of that element; hence M. Majendie conceived that its secretion depends upon the nitrogen received from alimentary substances, since the urine of animals, confined to food that does not contain it, is free from lithic acid.† (31.) Unlike urea, it does not pre-exist in the blood, but would appear to be elaborated by the kidneys, although in certain morbid states it must evidently find its way into the circulation, since the "*chalk-stones*" deposited in the cellular membrane of gouty persons are composed of *Lithate of Soda.*

309. *The Alkaline and Earthy Phosphates.* The phosphoric acid would appear to exist in the urine in combination with

* The property which urine possesses of reddening litmus-paper, depends upon the *Lithate of Ammonia,* and the *Bi-phosphate of Ammonia,* which are known to have an acid re-action. Dr. Prout remarks upon the singularity of the co-existence of these salts. It might be supposed that the excess of phosphoric acid would throw down the lithic acid, but this is not the case. We have many parallel cases of super-salts, in which the acid is thus retained by the base, viz. hydriodate of potass is instantly decomposed by tartaric acid, but the bi-tartrate (cream of tartar) produces no change in it.

† The lithic acid was formerly, at the suggestion of Dr. Pearson, termed *Uric* acid, and that name is still maintained by some modern writers; it is, however, very objectionable on account of the close resemblance which it bears to that of urea, a substance totally distinct from it.

soda, potass, and ammonia, as well as with magnesia and lime; and in such proportions as to constitute *super*-salts, or *Bi-phosphates*, upon which their solubility depends.

310. *Lactic Acid* probably exists in combination with ammonia, and with urea.

II. The changes which the several constituents of the urine may undergo in quantity or quality.

311. Physiology has taught us that the function of the kidneys is to remove superfluous and deleterious matter from the system;* no wonder, therefore, that its secretion should vary in quantity and degree of concentration with the causes that imply its necessity. Chemistry has also shown with what delicacy the various affinities which determine the several combinations are balanced; we cannot be surprised, therefore, that the latter should be liable to numerous modifications—an acquaintance with which is essential to a knowledge of the morbid changes which the urine may undergo.

312. *Lithic Acid* appears to be susceptible of numerous modifications. By the action of nitric acid, diluted with about an equal bulk of water, and submitted to a moderate heat, we obtain, by a gentle evaporation, transparent colourless crystals, which constitute the *Erythric Acid* of Brugnatelli (the *Alloxan* of Liebig). If, however, the nitric acid be more dilute, we have a different result, the crystals in that case are less soluble in water, and assume a different form; it is said to differ from the former acid in containing one proportional more of hydrogen. Liebig has given to it the name of *Alloxantin*. Dr. Prout had long since discovered that, if into a strong solution of the crystals of *Erythric Acid*, whilst boiling hot, we carefully drop some pure ammonia, the solution acquires a beautiful purple colour, and crystals of "*Purpurate*

* The ancients considered the urine as a kind of extract of animal substances, a true lixivium, by which everything impure in the animal economy was washed away, and hence they gave it the name of Lotium.

of Ammonia" speedily form and subside. If these crystals are treated by means of potass and sulphuric acid, pure "*Purpuric Acid*" is obtained in the form of a yellowish or cream-coloured powder. The subject has lately been re-examined by Liebig with his accustomed ability, and he has materially modified our former opinions with regard to the chemical constitution of these bodies. The "*Purpuric Acid*" of Prout, to which he has given the name of *Murexan*, he says is not an acid, while the *Purpurate of Ammonia*, which he calls *Murexid*,* is a combination of *Alloxan*, *Alloxantin*, *Ammonia*, and the elements of water; but these ultimate analyses are merely objects of abstract interest, and it is unnecessary to trouble the practitioner with any further account of them, except to observe that the lithic acid may, through chemical agencies, to which the urine is exposed from the re-action of its own elements, be made to assume various characters, by which the aspect of urinary sediments will be influenced; there cannot, for instance, be any doubt that in certain states of disease, the *Purpurate* may give to the sediments those beautiful hues which were formerly attributed by Prout to an acid which he called the *Rosacic*.

313. *Hippuric Acid* occurs in combination with ammonia or soda, in the urine of the graminivora, such as the horse and cow. Dr. Prout observes that, except it exists in the urine of young children, and has been mistaken for benzoic acid by Scheele, he is not aware that it has been detected in human urine, at least in its healthy state, although M. Wittstock is said to have found it in diabetic disease; but Dr. Prout thinks it may have been confounded with the *Lactate of Urea*. The question, however, has lately received a re-

* Most heartily do I join Dr. Prout in his protest against the introduction of such barbarous terms. Besides the substances already mentioned, Liebig has described several others as produced from lithic acid, *viz. Alantoin*; ("Alantoic acid" of Vauquelin:) *Cyanuric Acid*; (*Pyrouric* acid of Scheele;) *Cyamalid*; (insoluble Cyanuric acid;) *Alloxanic Acid*; *Mesoxalic Acid*; *Mykomelinic Acid*; *Parabanic Acid*; *Oxaluric Acid*; *Thionuric Acid* (containing sulphur;) *Uramil*; *Uramilic Acid*.

newed interest from a paper read before the Medico-chirurgical Society by Dr. Ure; and should the facts therein stated be verified, they may lead to some important improvements in our practice. He states that when a certain portion of benzoic acid, or of a soluble benzoic salt, be introduced into the human stomach, the urine voided in the course of a couple of hours will be found to yield a quantity of hippuric acid, the lithic acid having entirely disappeared; thus, he observes, by this singular interchange of elements, we have an organic product, (*Lithic Acid,*) containing eight atoms of nitrogen and ten of carbon, replaced by one (*Hippuric Acid*) containing no less than eighteen of carbon, and only two of nitrogen;* but the important circumstance connected with this research is, that the salts which this new acid forms with the ordinary bases occurring in the animal fluids are all of easy solubility; thus *Hippurate of Soda* requires about two parts of water at 60° for its solution, whereas the *Lithate* of soda is nearly as insoluble as the pure lithic acid; *Hippurate of Ammonia*, again, is little less soluble than *Hippurate of Soda*, whereas *Lithate of Ammonia* will only dissolve to the amount of 1-450th part; *Hippurate of Lime*, the least soluble of these salts, according to Dr. Ure, requires eighteen parts of water to dissolve one part. The application of these facts, should their truth be established, is most important, and I shall have occasion to revert to them in a future section.

314. *The Earthy Phosphates* may, from an excess in quantity, be separated from the urine, or they may fall down from the action of an alkali abstracting a proportional of phosphoric acid; or a *triple Phosphate of Magnesia and Ammonia* may be produced by the developement of ammonia, as will be presently explained.

* There are several tests by which the *Hippuric* may be distinguished from the *Benzoic* acid. Sulphuric ether, however, affords the readiest method,—*Benzoic* acid being soluble in two parts of that liquid, whereas *Hippuric* acid is very sparingly soluble in it.

315. *The Alkaline Principles* of the urine are often in excess; and it has been observed that an excess of the fixed carbonate alkalies is always accompanied by that of the carbonate of ammonia, a condition of the urine which is highly favourable to a deposition of the phosphates.

316. *Urea* would appear, under certain circumstances, especially if the fixed alkalies be in excess, to be converted by the kidneys, or occasionally to be decomposed in the bladder, into carbonate of ammonia, which thus becomes the active agent in precipitating the *Phosphate of Magnesia* in the form of the triple phosphate.

317. In addition to those already enumerated, and which may be regarded as the essential ingredients of urine, there are to be found in certain morbid states the following principles:—*Albumen*—*Fibrin*, and the *colouring matter of the blood*, which have passed unaltered through the kidneys—*Nitric Acid*—*Oxalic Acid*—*Benzoic Acid?* *Hippuric Acid?* *Carbonic Acid* — *Xanthic Oxide* — *Cystic Oxide* — *Sugar* —*Bile*—*Pus*—and *Mucus*. The origin of several of these bodies is sufficiently obvious, while there are others which may raise a question as to whether they be only separated from the blood, or be formed by the action of the kidneys out of the unassimilated matters presented to them. With respect to the *Oxalic Acid*, although there is reason to regard it as an animal product generated in the system, we must at the same time admit that it is occasionally a mere educt from the alimentary substances which have been taken into the stomach (35 and *note*).

318. Such, then, being the changes of which the leading principles of the urine are susceptible, we may next examine the nature of the deposits derived from them. Dr. Prout considers, that, although composed of the same general ingredients, mechanical deposits may, in a pathological point of view, be conveniently arranged under three divisions, *viz.* 1st. *Pulverulent*, or *Amorphous Sediments*. 2nd. *Crystalline*

Sediments, usually denominated *Gravel*. 3rd. *Solid Concretions*, or *Calculi*, formed by the aggregation of the preceding.

319. 1. *Amorphous Sediments.* These may consist of the *Lithate of Ammonia*, or the *Lithate of Soda* or of *Lime*, in combination with some colouring matter; or they may consist of the *Phosphate of Lime*, or the *triple Phosphate of Magnesia and Ammonia*. In the latter cases they are generally white, or very faintly tinged. On some occasions the sediment will be found to consist of a mixture of both the last-mentioned phosphoric compounds.

320. 2. *Crystalline Deposits.* When the *Lithate of Ammonia* is decomposed by a free acid, the lithic acid falls down in the form of small crystals, commonly called *Red Gravel;* whereas the *Triple Phosphate* is deposited as white shining crystals, known by the name of *White Gravel;* or sometimes it forms as a pellicle upon the surface, exhibiting prismatic colours. I have just seen a striking case of this kind, in which the patient sent for me in considerable alarm, in conquence, as he said, of "voiding *rainbows*"—the urine was alkaline, and after standing for a short time yielded the odour of ammonia.

321. 3. Solid Concretions, or Calculi. Nitric acid may be habitually discharged for years, before that condition of kidney takes place which appears to dispose its concretion into a calculus. It seems probable that the mucous lining takes on an inflammatory action, by which agglutinating matter is thrown out; at least this may be one of the causes, and Mr. Earle has endeavoured to show that the formation of renal calculi may sometimes arise from a local injury affecting the loins and kidney. The lithic acid would appear to be deposited in the *tubuli uriniferi* in a hydrated gelatinous state, and becoming more or less concreted, from the absorption of its water, escapes into the *infundibulum* and *pelvis* of the kidney, from which it may be propelled by the current of urine along the ureter into the bladder. In this way the

same individual has been known to void some hundreds of such concretions in succession, from the size of a pin's head to that of a horse-bean. Should the calculus, after having found its way into the bladder, be unfortunately retained in that cavity, either in consequence of its size, or of the obstruction offered to its exit by an enlarged prostate, it very shortly increases in size by the deposition of fresh calculous matter, for there always exists a disposition in the urine to form deposits around foreign bodies, especially if they occasion irritation of the bladder. Although a renal calculus generally derives its origin from the kidney, it may originate in the bladder itself. When sawn asunder, its nucleus will generally be found to be either *Lithic Acid*, or *Oxalate of Lime*. The nature of the subsequent incrustations will necessarily depend upon the character of the urine, and the changes which it may from time to time undergo. The experience of Dr. Prout has enabled him to deduce the following general conclusions. The phosphates rarely form the nucleus, but being once deposited, they continue to be so, and are never followed by other depositions. They may succeed the lithic acid, or the oxalate of lime, but neither of these ever succeed the phosphates. If the external surface of a calculus is composed either of the lithic acid, or of the oxalate of lime, we may be certain that there are no phosphates in the interior; whereas, if there be phosphates on the exterior, the general rule is that some other substance lies beneath them. The reason of this may be, that the deposition of the phosphates is generally the effect of local or constitutional irritation, occasioned by the presence of a lithic acid, or oxalate of lime calculus.

322. No department of chemical physiology has been more enlightened by modern science than that of the history and composition of calculi; indeed, with regard to the latter, there is very little left for us to desire. Scheele was the first chemist who attempted to analyse these bodies, and so imperfectly was this accomplished, that he considered every calculus to

consist of one and the same concrete acid, soluble in alkaline lixivia, and to which Morveau gave the name of *Lithic Acid.* Compare this statement with the researches of Fourcroy, Vanquelin, Pearson, Brande, Wollaston, Henry, Marcet, and Prout, who have demonstrated not only the existence of several distinct bodies in the composition of urinary calculi, but the manner in which they are combined, and the general order in which they are deposited, as exhibited in the following arrangement, for which I am principally indebted to the work of Dr. Prout.

1. LITHIC ACID CALCULUS.

External Characters.—*Form*, a flattened oval; *specific gravity* generally above 1·500; *colour*, brownish or fawn-like; *surface* generally smooth, although occasionally finely tuberculated; *texture* laminated.

Chemical Characters.—Before the blow-pipe it is gradually consumed, emitting a smoke of a peculiar smell, and leaving a residue of white ashes of an alkaline character. It is soluble in a solution of caustic potass, from which it may be precipitated by an acid in the form of a white granular powder. If a drop of nitric acid be added to a small particle of it, and heat be applied, the lithic acid is dissolved, and on evaporation to dryness, the residue assumes a beautiful pink or carmine colour.

2. LITHATE OF AMMONIA CALCULUS.

External Characters.—*Form*, smooth, but occasionally tuberculated; *colour*, clay-like; *texture*, concentric layers.

Chemical Characters.—Before the blow-pipe it frequently decrepitates. It differs from the lithic acid calculus, in being more soluble in water, and in being soluble in the solutions of the *carbonated* alkalies; the carbonic acid uniting with the ammonia, and the fixed alkali with the lithic acid. This calculus is rare, and is principally confined to children.

3. OXALATE OF LIME, OR MULBERRY CALCULUS.

External Characters.—*Form*, rough and tuberculated, hence the term *Mulberry*;* *colour*, deep brown, or very dark olive-green, or black; *texture*, harder than that of the other species, and of a more or less perfectly laminated texture; *specific gravity*, from 1·428 to 1·976.

Chemical Characters.—In the flame of the spirit-lamp it swells out into a white efflorescence, which is *quick-lime*, and will redden turmeric paper. It is also to be distinguished from the phosphates by being nearly insoluble in acetic acid.

4. PHOSPHATE OF LIME, OR BONE-EARTH CALCULUS.

External Characters.—*Form*, frequently smooth on its surface, and polished like porcelain; *colour*, pale brown; *texture*, regularly laminated; it is seldom of large size, and is not very common.†

Chemical Characters.—It is generally quite infusible, or fusible with extreme difficulty. It is soluble in hydrochloric acid, and is re-precipitated by pure ammonia.

5. THE TRIPLE-PHOSPHATE CALCULUS.

External Characters.—*Form*, surface uneven, and studded with minute shining crystals; *colour*, nearly white; *texture*, not laminated, but pulverulent.

Chemical Characters.—Before the blow-pipe it gives off the odour of ammonia, and at length melts with difficulty.

* There is a variety of this calculus, which is remarkably smooth and pale-coloured, and usually contains a mixture of the *Lithate of Ammonia*. From the smallness of their size, and their general appearance, they have been termed *Hempseed* calculi.

† *Prostatic Calculi* generally consist of phosphate of lime, and a small portion of the carbonate, with some animal matter.

By the action of caustic potass it also yields ammonia. It is much more soluble than the preceding species in dilute acids, from which it is again precipitated by ammonia in its original crystallised form.

6. THE MIXED, OR FUSIBLE CALCULUS.

External Characters.—*Form*, a friable mass, leaving a white dust on the fingers; *colour*, whiter than any of the other species. It often assumes a very large size; it is of frequent occurrence.

Chemical Characters.—We have seen that the calculous ingredients of which it is compounded, viz. *Phosphate of Lime*, and the *Triple Phosphate of Ammonia and Magnesia*, are each separately infusible, and yet in combination a body is produced so fusible before the blow-pipe, as to have gained the epithet *Fusible*.* It also dissolves readily in acids, and particularly in dilute hydrochloric acid; and if to the solution (not too acid) the oxalate of ammonia be added, the lime is precipitated alone, and the magnesia may be afterwards separated by the addition of pure ammonia.

7. THE ALTERNATING CALCULUS.

External Characters.—Its section exhibits different concentric laminæ; hence its general appearance, texture, and chemical characters, will vary with its composition. Some remarks with regard to the general disposition of its ingredients have been already noticed (318).

* In connexion with this subject, I cannot resist the pleasure of introducing an anecdote, which I have published in my life of Sir H. Davy, so highly illustrative of that habit of minute observation which enabled Dr. Wollaston to press into his service at the moment such ordinary and familiar materials as would never have occurred to less observing chemists. Mr. Brande had called upon Dr. Wollaston to consult him upon the subject of a urinary calculus; upon his finding it refractory under the blow-pipe, he took up his ivory paper-folder, and scraping off a fragment, placed it on the specimen, when it instantly fused.

8. THE MIXED OR COMPOUND CALCULUS.

External Characters.—*Form*, generally small, and is more frequently found in early life; its characters are necessarily of an ambiguous nature, and will vary with its composition, but it usually assumes more or less of the characters of the predominant ingredient.

Such are the more usual species of calculi; there are a few others, but of such rare occurrence as not to require any description in this work: *e. g.* The *Cystic Oxide*, and the *Xanthic Oxide* Calculi—the *Fibrinous Calculus*, which latter consists principally of the fibrin of the blood; and the *Carbonate of Lime Calculus.*

III. The condition of the system under which deposits take place, or the causes by which they are induced.

323. The line of demarcation by which healthy and morbid urine are separated from each other, is so vague and fugitive, that it is not easy to define its limits; nor, generally considered, are slight deviations of any material importance; the boundary is daily exceeded by persons in ordinary health, not only without mischief, but without even any consciousness of the event; slight excesses or errors in diet, unusual exercise, or unaccustomed rest, may produce a passing influence upon the character of the urine; but of such little moment are such occasional deposits regarded, that Dr. Prout has distinguished them by the term of "*Sediments of Health;*" indeed, they may sometimes be considered even as salutary excretions, carrying off from the blood unassimilated matters, which, if retained, might become sources of mischief; but to these again, there is a limit which the judgment of the practitioner can alone determine. The continuance of such sediments would, moreover, denote a state of the system which, under the necessary circumstances, might raise them into the im-

portance of gravel or of stone, of which they are the elements.

324. It has been stated that there are two very distinct species of deposit, the one consisting of lithic acid, the other of phosphoric acid, in combination with different bases. The state of the system, in its relation to these deposits, is as different as the deposits themselves. The lithic acid diathesis always denotes a *sthenic*, while the phosphatic diathesis is as strongly indicative of an *asthenic* condition. In the one case the urine is generally acid, in the other its tendency is to become alkaline. The decomposition of the *Lithate of Ammonia* takes place from the action of an acid, and it is probable that in the living body the *Lactic Acid* is the agent by which it is effected, although in some cases we may suppose that it is at once secreted in a free state by the kidney. Now the lactic acid, as already stated, (231,) is one of those forms in which Nature expels excrementitious matter from the system, through the pores of the skin, or through the kidneys; if, therefore, it should be abundantly secreted, or its usual exit through the medium of the perspiration be obstructed, a preternatural quantity will be thrown upon the kidneys, and lithic acid be thus precipitated. This view receives confirmation from the experiments of Dr. Prout, who says that he has observed a superabundance of the *Lactate of Urea* in urine depositing lithic acid. Dr. Wilson Philip, in a paper published in the Medical Transactions, maintains that the precipitating acid, in a state of health, is thrown off by the skin, and that it is by an obstruction of its functions that the lithic acid is deposited. Dr. Scott and other tropical practitioners have stated that calculous diseases are almost unknown in those latitudes, which would certainly seem to connect the active function of the skin* with the absence of

* Sir Gilbert Blane, many years since, noticed an apparent connexion between cutaneous eruptions and urinary deposits, and the truth of the observation has been confirmed by experience; Dr. Prout observes that he has no doubt upon the subject.

urinary deposits. Mr. Copland Hutchinson, in a paper published in the Medico-Chirurgical Transactions, has shown a comparative rarity of calculous disorders in British seamen. Can the saline quality of their food, from its stimulating influence upon the functions of the skin, offer any explanation of the fact? *

325. Indigestion is the common cause of the deposition of lithic acid; I have for many years been in the habit of inspecting the urine of dyspeptic patients, and I have obtained ample evidence of the intimate connexion which subsists between imperfect assimilation, and the occurrence of such sediments. They are also very usual indications of that state of the system, so ably described by Dr. Barlow under the name of *Excrementitious Plethora*, (230,) and which, where a predisposition to the disease exists, may induce gout. Sir B. Brodie observes, that "in what are called the better classes of society, you find the deposition of red sand to exist chiefly in adults, but in the lower classes you find it chiefly among children. These circumstances are easily explained. Adults in an affluent condition usually lead a more luxurious and indolent life than their children; while among those of the lower orders the diet of the children is generally unwholesome, and little attention is paid to the various derangements of the digestive organs to which they are liable.

326. Unlike the lithic acid deposits, the phosphatic sediments denote a cachectic or asthenic state of the system; alkaline urine is the result of debility. Sir B. Brodie has well illustrated this subject by the following case. "A gentleman who attended my lectures, called to consult me con-

* Sir B. Brodie is disposed to question the fact of seamen being less liable to such diseases. "If you bear in mind," says he, "the greater prevalence of the disease among children, and those who are advanced in life, and recollect that among sailors there are no children, and very few old men, you have a sufficient explanation of the fact in question. Besides, it must be difficult to obtain sufficiently accurate data for an opinion."

cerning his general health. After a careful inquiry, I was not able to discover any marks of local disease. It was not one function in particular, but all his functions that were deranged. He had been in the habit of sitting up to write out his notes until two in the morning: he had risen from his bed at six; he had worked all day both with his hands and his head—in short, he was suffering from excessive labour of both body and mind. I said to him, 'Your case is not one which medicine alone will cure; you must study less and sleep more. Your system is in that state which will lead to your having alkaline urine, if you have it not already.' He went into the adjoining room to make water, and immediately on it being voided I tested the urine, and found it to be alkaline, as I had anticipated." Whatever depresses the power of life, disposes the urine to become alkaline; hence injuries of the spine, as first noticed by Sir B. Brodie, are frequently followed by such an effect.* The transformation of urea into carbonate of ammonia, is generally the source from which the phosphate of magnesia derives its ammoniacal precipitant;† and this may take place in the bladder in cases where it has lost its *governing power*, as from diseases in the spinal marrow, or from some local affection of the bladder, or prostate gland, in consequence of which the urine being detained, undergoes an incipient process of putrefaction; hence in elderly people, who are frequently incapable of wholly evacu-

* "It is a very old opinion," says Dr. Prout, "that injuries of the back produce *alkaline* urine; it also appears to hold in other animals as well as in man; thus I have frequently observed jaded and worn-out horses pass great quantity of lime in their urine; I have known the same also to take place in dogs, and particularly in those of the sporting kind; and in both these instances have thought it probable that the circumstance was connected with some strain or injury of the back, produced by over-exertion, or other causes.

† Whenever the urine undergoes an incipient process of decomposition, ammonia will be generated. I have in my possession a splendid specimen of the triple phosphate produced by the dripping of urine on a beam of wood; it had been taken from a privy in the Borough. I lent the specimen to the late Mr. Wilson, for exhibition at his lectures, and he has published a description of it in his work on the Urinary Organs.

ating the bladder, the deposition of the triple phosphate is very common. Alkaline urine is also highly deleterious in another point of view, by acting as an irritating application to the membranous surfaces with which it comes in contact; after some time it induces a chronic inflammation of the mucous membranes of the kidneys and ureter, extending to that of the bladder, the consequence of which is the formation of a ropy adhering mucus, accompanied with a deposition of lime, to such an extent even, as occasionally to be voided like fragments of mortar; and should it be blended with the triple phosphate, would give origin to the "*Fusible*" calculus. Upon this subject the practical observations of Sir B. Brodie are most valuable; and to his excellent lectures upon calculous diseases* I must refer the reader.

IV. The remedial means by which deposits may be prevented.

327. As urinary deposits are to be viewed as indications of constitutional disturbance, our prime object will be to correct the particular condition of the system upon which they depend. At the same time it may be essential to adopt such chemical means as may prevent their deposition in the form of gravel or calculus.

328. We have stated that the deposition of the *Lithates* denotes an imperfect performance of the digestive functions, and is generally accompanied by an overloaded or plethoric state (321). The indication in such a case is to restore the assimilative organs to a healthy condition, by a judicious regulation of the diet and habits of the patient. The decomposition of the *Lithate*, and the consequent deposit of the insoluble lithic acid, constituting "*Red Gravel*," is the effect of an acid re-agent generated in the system. To counteract which care must be taken to avoid such articles of food as are likely to become acescent;† and at the same time we

* *Medical Gazette* before quoted.

† It is not possible to enumerate the obnoxious articles, as persons are very differently affected by the same kind of food. There are some,

must endeavour to promote a healthy action of the skin by exercise, and, if necessary, by the use of vapour-baths,* by which the system will be relieved from the acid matter which must otherwise pass off by the urine (324). The antilithic medicines to be employed in such cases are the several alkalies, and alkaline earths, especially magnesia. Dr. Prout prefers potass to soda, for the reason already stated, (245,) and its carbonate is found to answer as effectually as the alkali, while it has the advantage of being less liable to disagree with the stomach. Mr. Hatchett first proposed the carbonate of magnesia, in doses of ℈j to ʒj, as a valuable substitute for alkaline remedies in cases of the lithic acid diathesis; but as its insolubility must render its absorption doubtful, its beneficial operation must principally depend upon its neutralizing the excess of acid in the first passages; and in this way there can be no doubt of its antilithic agency, for the first link in the series of actions, which cause the disposition to these deposits, has its origin in the stomach; "but," says Dr. Marcet, "such is the tendency which the public has to overrate the utility of a new practice, or to take a mistaken view

however, which may be mentioned, as more particularly liable to create a tendency to this deposit. In the first place, a diet wholly composed of animal food is objectionable; it should be mixed with a fair proportion of well-dressed vegetables. Hard dumplings, and heavy ill-fermented bread, crude vegetables, unripe fruit, pastry, &c., are liable to produce this deposit. Amongst liquids, the free use of acid wines, or such as have a tendency to become acid in the stomach from an excess of sugar, are highly objectionable. I confess I am not disposed to concur with Dr. Prout in his general censure of malt liquors. If sound and well-fermented, they may even assist digestion, upon a principle already explained (83). There has long existed a popular prejudice in favour of the antilithic virtues of malt liquor, and I see no good reasons for rejecting it. In the observations made upon the bills of mortality in the year 1662, by an ingenious citizen, concerning the increase of some diseases, and the decrease of others, it is said, "The stone and strangury decreaseth from the drinking of ale."

* Sir B. Brodie strongly recommends the use of the hot-air bath for producing copious perspiration in these cases, and he observes that the perspired matter so produced is highly acid, reddening the blue litmus paper even more readily than it is reddened by the urine.

of its proper application, that there is every reason to believe the use of magnesia has of late years become a frequent source of evil in calculous complaints." The same observation will equally apply to the use, or I should rather say to the *abuse*, of alkalies; Sir B. Brodie has very justly observed, that in the exhibition of these chemical remedies much caution is necessary; the practitioner should be provided with paper, coloured blue by an infusion of litmus, and also with the same test slightly reddened by immersion in a very weak acid. Healthy urine will turn the blue paper a little red, and alkaline medicines ought not to be given in such a dose, or to such an extent, as altogether to destroy this property; still less ought the urine to be rendered alkaline; should it, for instance, turn the red test-paper blue, the patient will be in danger of suffering from a deposition of the phosphates. Lime-water has also been recommended, as being less likely to occasion that irritability of the stomach which commonly follows the long-continued use of the fixed alkalies. From the theory frequently adverted to in this volume, (132,) the fact first noticed by Sir Gilbert Blane admits of a ready explanation, viz. that an alkali, although exhibited in combination with citric acid, will equally affect the urine; the common saline draught will therefore offer an agreeable mode of administering an alkaline antilithic.* The occasional interposition of an aperient will also be necessary during an alterative course, but we must not combine it with the antilithic, nor so administer it as it may interfere with its absorption, if at least it be our object that the latter should reach the kidney; for it is a law which I have already attempted to establish, that *Catharsis will suspend the process of absorption* (134). I have known a brisk cathartic frequently give an immediate check to the deposition of lithic acid, by its salutary influence

* Some of the alkaline mineral waters will be found not only agreeable, but efficacious remedies. Those of Vichy, which are strongly impregnated with the carbonate of soda, with an excess of carbonic acid, deservedly enjoy a high reputation. The "*Liquor Potassæ Effervescens*" of our Pharmacopœia is also a valuable medicine. See ANTACIDS.

upon the digestive organs. The benefits arising from the exhibition of antacids in these cases, is often very materially promoted by a judicious combination with other remedies. The union of potass and ammonia with the infusion of *Serpentaria* is a combination to which I attach much value; the latter ingredient, while it determines to the skin, renders the stomach more tolerant of the alkali. Under the class of antilithics, I have given a formula for its preparation. As the urine is most acid about three or four hours after dinner, alkaline remedies should be given at that period.

329. The recent experiments of Dr. Ure have led to the singular conclusion that benzoic acid has the property of converting the *Lithic* into the *Hippuric* acid (310). If this be true, we are presented with an agent that may be very usefully applied. Upon this subject Dr. Ure states that either the benzoic acid itself, or a benzoic salt, will fulfil the desired indication, the dose being regulated according to the state of the renal secretion. Since, however, the acid is liable to irritate the fauces, unless administered in a liquid form, and as a large proportion of water would be necessary for its solution, he proposes to combine it with the *Phosphate* or *Biborate of Soda*, either of which salts will enhance its solubility without abating its specific power. Thus four parts, by weight, of the former, or one part and a half of the latter, will enable a comparatively small proportion of distilled water to take up one of the acid. Now phosphate of soda not only serves to hold benzoic acid, but likewise hippuric acid, in solution, a point of some importance, since any excess of this latter acid, which might be accidentally present in the urine, would remain dissolved by means of the neutral phosphate of soda, or the triple phosphate of soda and ammonia naturally existing in that secretion.* The reader will find the necessary formulæ under the antilithic prescriptions.

* The action of lithic acid upon the phosphate of soda is to convert this salt into a bi-phosphate, by uniting with one half of its base, and becoming thus in its turn the *Lithate of Soda*. Upon which fact Dr.

330. In concluding our remarks upon the methods of treating lithic acid deposits, we must repeat our conviction of the great importance of attention to diet, and to the healthy condition of the skin; for effecting the latter object, air-baths, frictions, exercise, and flannel, will be found important auxiliaries. It has been stated that lithic acid deposits may be occasionally regarded as salutary, (320,) that is to say, they may carry off from the system some deleterious matter, which by the action of the kidneys is separated in that peculiar form. It would moreover appear that there exists a class of remedies which might not unaptly be termed *Lithagogues*, since they induce the renal organs to secrete a superabundant proportion of the *Lithates*, in cases where we may reasonably suspect the presence of a *materies morbi* in the system; such, for example, are certain stimulating diuretics,* and colchicum. If, however, we employ these agents for such an object, we should be careful to examine the urine, with a view to check an excess of acid, by which the lithic acid might be deposited in its crystalline form. To meet these views, the practitioner will find several formulæ which I have ventured to designate as *Lithagogues*.†

Ure offers the following ingenuous speculation. "It appears to me to furnish a simple and rational explanation of the mode of formation of lithate of soda, the basis of gouty concretions, or chalk-stones."

* Dr. Marcet tells us that he was informed by Dr. Henry that he had seen several instances in which a quack medicine, apparently composed of turpentine and opium, produced a very large secretion of lithic acid.

† While correcting the present sheet, a case has occurred in my own practice, highly illustrative of these views. A strong athletic person, evidently labouring under a redundancy of nutritive matter, had for several days been suffering from an attack of rheumatism in his several joints. Having been freely purged, I gave him half-drachm doses of the wine of colchicum every six hours; after the second dose, the urine, which had been only slightly turbid, became so loaded with lithate of ammonia, as to give it considerable consistency. The pains were materially mitigated, and in the course of three days were entirely removed, after which the water regained its transparency. I regret that I did not ascertain the quantity of lithic acid deposited, but it must have been very considerable.

331. In adopting measures for checking the deposition of the *Phosphates*, the practitioner will remember that he has to deal with a condition of the system very different from that which characterises the *Lithic Acid* diathesis (321, 323). He has to build up a constitution broken down by care or labour, or by the inroads of organic disease; he will therefore be called upon, according to the circumstances of each particular case, to administer constitutional remedies, for which no general rule can be given; although he may derive some important hints for practice from the precepts we have endeavoured to inculcate under the consideration of stimulants (56). At the same time there is an important chemical question involved in the treatment, and since the remedies which this science may suggest are not incompatible with the medicinal operations of vital agents, both may very frequently be combined with advantage, as the practitioner will hereafter learn.

332. As the *Phosphates* are deposited by an alkaline reaction of the urine, it is evident that *Acids* are the appropriate antilithics; but we ought to be well satisfied with respect to the condition of the urine and its deposits, before we prescribe either an acid or an alkali; it is evident that whenever that natural acidity of the urine is neutralized, which is necessary for keeping the phosphoric salts in solution, we shall produce a sabulous deposit; hence, says Mr. Brande, it occurs in persons who drink soda-water, or take magnesia in excess. In cases indicating the expediency of an acid, the *Hydrochloric*, or *Nitric*, will in my judgment be found as convenient and effectual as any that can be administered. Mr. Brande proposes *Cream of Tartar* for this purpose: upon this point, however, I differ from him, *toto cælo;* for this salt, to say the least of it, is questionable in its mode of operation; for although its first impression upon the stomach may be that of an acid, the subsequent processes of digestion decompose it, and eliminate its base, which, being carried to the kidneys, will act the part of an alkali. I have seen a white sabulous deposit, consisting of the phosphates, in the

urine, after the constant use of *Imperial* as a beverage, which I am at a loss to explain upon any other principle.

333. In cases of alkaline urine, associated with the secretion of ropy mucus, and its accompanying phosphate of lime, attention must be directed to the bladder, in order to subdue any insidious chronic inflammation or irritation that may exist in that organ. As a medicinal agent, Sir B. Brodie considers a decoction of the root of the *Pareira* (Cissampelos Pareira) to have a specific influence in restraining the morbid secretion; and as it is not incompatible with acids, it may furnish a convenient vehicle for their exhibition.

V. The means by which calculous deposits, retained in the body, may be removed.

334. Having disposed of the *modus operandi* of antilithics, we approach the far less satisfactory subject of *Lithonthryptics*. A calculus having been once formed, it is very doubtful how far we can succeed in re-dissolving it by chemical means; for although those bodies are unorganized, and therefore free from the control of the living principle, yet the powerful resistance which the cohesive force opposes, and the small surface which they present to the decomposing agent, in proportion to their mass, must render such a concentration of chemical power necessary for their solution, as neither the stomach nor bladder could bear with impunity. If, however, we are unable to succeed in materially affecting large concretions, yet, Dr. Marcet observes, we may make an impression upon small calculi, so as to blunt their sharp edges, and enable them to be discharged by the urethra with less difficulty or inconvenience: we may even do more, we may convert a rough into a smooth calculus; and we may prevent its further increase by modifying the character of the urine; but to effect these objects, great care and judgment are necessary, or we may aggravate the evils which we thus attempt to palliate. If a lithic acid calculus be present in the bladder, its increase may be prevented by alkalies; but should these

be carried too far, we shall occasion a deposit of the phosphates. "You will often hear," says Sir B. Brodie, "that under the use of alkalies, calculi have come by the urethra, broken down into fragments; but which are, in reality, not the old stone dissolved, but a new formation. They are actually generated by the alkalies, the mischievous consequence of the indiscreet and unscientific exhibition of these remedies. Such cases, instead of adding to the laurels of surgery, only show how this important and useful art may become a source of evil instead of good, when it falls into the hands of the inconsiderate or ignorant." What, then, it may be asked, become of all those cases which stand recorded in evidence of the disappearance of the symptoms of calculus, after the free use of the alkalies? They are to a certain extent fallacies; in some of these cases the stone has become encysted; Sir B. Brodie has related several instances of this kind, and has pointed out another circumstance which may occasion alleviation, viz. an enlargement of the prostate gland, and which he thus explains. "The more urgent

* This occurred in the case selected for the trial of Mrs. Stephens's solvent, as mentioned at page 90. This once celebrated nostrum consisted of lime, obtained by the calcination of the shells of eggs and snails, and made into pills with soap. A decoction was also administered, consisting of chamomile, fennel, parsley, and burdock, together with a portion of Alicant soap. Her observations respecting the administration of these remedies are by no means injudicious. "If," says she, "these medicines produce pain, it will be necessary to give an opiate with them, and it must at all times be a principal care to prevent a looseness, for if this should happen, it would carry off the medicines; under such circumstances, the quantity of the decoction, since it is laxative, must be diminished, and other suitable means be taken by the advice of a physician." This remedy has been rendered memorable from having engaged the attention of the celebrated Stephen Hales, and the no less distinguished David Hartley. The practice of giving alkalies in calculous disorders, did not, however, originate with Mrs. Stephens. Basil Valentine employed a fixed alkaline salt in such cases; and Sennertus, in his *Praxis Medica*, mentions a lithonthryptic that was in great esteem, and in general use in his time, which consisted of one ounce of *Salt of Tartar*, dissolved in a pint of *Parsley Water*, and afterwards tinged yellow with orange-peel.

symptoms produced by a calculus, arise from its coming in contact with the internal orifice of the urethra; but where the prostate is enlarged, making a tumor projecting into the bladder, this is in great measure prevented. The calculus becomes lodged, as it were, in the hollow behind the tumor, and is thus, in a certain degree, prevented falling down on the neck of the bladder; and if the enlargement of the prostate supervenes on a stone in the bladder, the symptoms of the latter disease are likely to be very considerably relieved." Here, then, we have at once an explanation of many of those cases which, *after* the protracted use of alkalies, have received relief. There are, however, instances of alleviation having been produced by the *solvent* powers of the alkali; in that of the uncle of the celebrated Horace Walpole, recorded by himself in the Philosophical Transactions for 1750, in which he insisted strongly upon the benefit he had received from the internal use of soap and lime water, the stones found in the bladder after death were, according to Sir John Pringle, round and smooth, and gave sufficient evidence of having been acted upon by the long-continued use of these medicines.

335. Independent, however, of chemical agency, experience has shown that alkalies have the power of allaying the irritation of the bladder, and promoting the flow of urine; in such cases, their beneficial effects will generally be enhanced by a combination with opium, as first pointed out by Sir Gilbert Blane.

336. The mineral acids would appear to exert a greater solvent influence upon calculi consisting of the *Phosphates*, than the alkalies do upon those of the *Lithic Acid*. Sir B. Brodie observes, that although it may not be possible to administer them by the mouth in such quantities as to render the urine sufficiently acid for the purpose, we are not to conclude that they cannot produce the effect if injected into the bladder through the urethra. He accordingly, several years since, commenced a series of experiments, by injecting

into the bladder extremely dilute nitric acid, which he gradually increased in strength, beginning with one minim to an ounce of distilled water. The instrument employed for this purpose is a catheter composed of the purest gold. It has a double channel, the two channels being separated from each other by a longitudinal septum running the whole length of the instrument. Each channel terminates by a distinct tube at the handle, and has a separate eye or opening at the other end of the catheter; a liquid may be thus injected into the bladder, entering it by one passage, and flowing out of it by the other, so that there may be a current through the bladder. The liquid is to be injected very slowly, and to be used over and over again several times. After which, if tested by a concentrated solution of ammonia, the phosphates will be precipitated. I am desirous of drawing the attention of the practitioner to this method, because it is applicable in those cases in which neither lithotomy, nor the more recent lithotritic operation, can be performed with safety or success, viz. in those of the deposition of the phosphates, accompanied with a diseased state of the prostate and bladder, with the secretion of that ropy adhesive mucus which the coats of the bladder so generally produce, when in a state of chronic inflammation. In such cases, the patient will receive considerable relief from such a practice; the ropy secretion will be diminished, and the calculi very probably dissolved, or so broken into fragments, as to pass through the ordinary channel.

337. In the former editions of this work, I described an ingenious application of electricity, as proposed by MM. Prevost and Dumas, for the purpose of decomposing the calculus in the bladder; but admitting even that such an effect could be produced, the process would only admit of application in such cases as are now successfully cured by *Lithotrity*.

ESCHAROTICS, *Caustics.*

338. Substances whose application to the animal solids corrodes or decomposes them.

339. The operation of these bodies may be considered chemical, since in consequence of their affinities being more powerful than the vitality of the part to which they are applied, they cause, as it were, by a species of resulting affinity, the elements of the animal matter to enter into new combinations; this is well exemplified in the action of caustic potass, in which the nascent elements thus disengaged by decomposition, combine with the alkali, and generate a saponaceous matter, which may be observed to form a film over the ulcerated surface, while the nitrogen and hydrogen disengaged during the action of the caustic form ammonia, which may be rendered sensible by inverting over the surface a small jar moistened with *Hydrochloric* acid, when the fumes of *Hydrochlorate of Ammonia* will become visible.*

340. The surgical value of these agents consists in their application to remove excrescences, or morbid growths; to open abscesses, to establish an artificial ulcer, or to convert an ulcerated surface into a simple sore, and to destroy parts infected with poison. For which purposes, various substances have been employed, which differ not only in intensity or strength, but in specific effects, e. g. the strong Acids; the Alkalies; Nitrate of Silver; Chloride of Zinc; Sulphate of Copper, Bi-chloride of Mercury; Arsenious Acid; the selection of the most appropriate caustic must, of course, be guided by the circumstances of the case, and the effects we intend to

* Or by holding over the surface of the sore a piece of white paper, moistened by a mixed solution of nitrate of silver and arsenious acid, when the disengaged ammonia will enable the arsenious acid to decompose the salt of silver, and form an arsenite with that metal, which is immediately recognised by its characteristic yellow indication. This is a delicate and summary test of the presence of ammonia.

produce. The *Potassa Fusa* (*Causticum Commune Acerrimum*) is a hydrated protoxide of potassium, and being deliquescent, is rapid and powerful in its effects; care is therefore necessary to prevent its acting to a greater extent than is required; we are, however, able to neutralise its action by touching it with vinegar, and thus to arrest its progress in an instant; in consequence of its chemical action upon the skin, it is not only liable to produce a large eschar, but to encourage hæmorrhage by rendering the blood more fluid, and opposing its coagulation, for which reasons *Nitrate of Silver* may, on some occasions, deserve a preference,* since that substance coagulates animal matter, and disposes the ulcer to form healthy granulations. *Chloride of Zinc* has similar advantages, and it has been successfully employed by Mr. Guthrie in cases of Necrosis, for by destroying the animal tissue of the bone, it disposes the earthy matter to soften and become detached. For a similar purpose, the surgeons of the infirmary of Gloucester have been in the habit of applying cataplasms of *Acetic Acid* to hasten the exfoliation of carious bone, by at once acting upon its earthy constituents. We are informed by Dr. Eberle,† that Dr. M'Clellan, induced from speculative views, has applied the dilute *Hydrochloric Acid* in the slow caries of some of the spongy bones with great advantage; and he adds, that it may be readily conceived that this acid may be introduced into a fistulous ulcer, in such a state of dilution as not to injure the healthy surfaces, and yet prove sufficiently strong to dissolve the dead bony spiculæ, and to excite the morbid parts to granulation. Nitric acid has also been employed as an escharotic for the

* Potass forms the basis of many of those preparations, sold as depilatories, which is sometimes combined with lime. Colley's depilatory appears to consist of quicklime and a portion of sulphuret of potass. By destroying the follicles which nourish and support the bulbs of the hair, we may certainly succeed in removing it.

† A treatise on the Materia Medica and Therapeutics, by John Eberle, M.D., vol. ii. p. 523.

destruction of tumors, and is valuable where an immediate destruction of diseased parts is required. The method of applying it is to smear all the sound parts in the immediate vicinity of the spot to be acted upon, with *Ung. Picis Nigræ*, and then to press pledgets of lint upon it, when in a few seconds the surface will be deadened, and a slough be produced, under which healthy suppuration and granulations will ensue. In a diluted state I have known the repeated application of this acid remove the most troublesome corns. *Burnt Alum* (Alumen Exsiccatum) has a degree of escharotic power which renders it serviceable in many cases, as in venereal chancres, as well as in ulcers having weak and spongy granulations; it is also employed to destroy fungous excrescences, but it should be remembered that, as it owes such power to an excess of acid, unless it be carefully prepared, it will be inefficient: the application of heat is for the purpose of expelling its water of crystallization, but should this have been too intense, or too long continued, it will be deprived of a great part of the acid. *Arsenic** and *Corrosive Sublimate* have been used as caustics, but the greatest circumspection and care are required in their application, since they are readily

* Plunkett's Ointment for Cancer consists of arsenious acid, sulphur, and the powdered flowers of the Ranunculus Flammula and Cotula Fœtida, levigated and made into a paste with the white of an egg, and applied on a piece of bladder to the surface of the sore.

Pate Arsenicale. This favourite remedy of the French consists of seventy parts of *Cinnabar*, twenty-two of *Sanguis Draconis*, and eight of *Arsenious Acid*, made into paste with saliva, at the time of applying it. This combination, with the exception of the *ashes of the soles of old shoes*, is similar to that recommended by Father Cosmo, under the title of "*Pulvis Anti-carcinomatosa.*"

Davidson's Remedy for Cancer. *Arsenious Acid* and *Powdered Conium.*

Delcroix's Poudre Subtil, "for removing superfluous hair in less than ten minutes!" This fashionable depilatory appears upon examination to consist of *Quicklime* and the *Sulphuret of Arsenic*, with some vegetable powder. It is, however, so unequally mixed, that in submitting it to analysis, no two portions afforded the same results.

absorbed into the system, and may produce the most alarming consequences. On my own personal knowledge I can state, that paralysis has been occasioned by the application of an arsenical ointment.

MECHANICAL REMEDIES.

341. This division includes such remedies as are supposed to owe their operation to mechanical principles, acting by their gravity, or by their power of creating, increasing, or diminishing, friction, or motion. Since we have discarded the theories of the mechanical and Iatro-mathematical schools, we acknowledge few agents of this nature; and we must agree with Dr. Murray in considering these even as the least important of all the articles placed at our disposal. It may be a question how far *Friction*, *Exercise*, &c. ought to be classed under the head of mechanical remedies; but whether we believe with Professor Müller, that friction induces slight chemical changes in the tissues, by which their affinities for the general *Vital Stimuli* are exalted; or suppose, with other physiologists, that it acts by stimulating the nervous centres, through the peripheral nerves, or are disposed to regard it as a mechanical agent, increasing the circulation in the capillaries, it cannot be denied that it is an agent of great power, and far too much neglected in the present day in the cure of disease.

342. It is possible that friction may act in all the three ways above stated. It certainly relieves the morbid effects of extreme abstinence, assists the absorption of effused fluids, accelerates a lagging circulation, restores sensibility to languid organs, and counteracts the evils of a sedentary habit; and when we remember that it is in the small circulation that

structural changes always commence, and that two of the most essential processes of animal life, nutrition and excretion, are exclusively performed by capillary vessels, we shall not be inclined to undervalue the importance of friction as an hygeian agent.

ANTHELMINTICS.

343. Remedies which expel worms* from the intestinal canal.

344. It has been already stated (115) that certain bodies have the power of increasing the peristaltic motion of the intestinal canal, by operating as mechanical stimulants upon its fibres; in this manner, the substances about to be noticed may very probably assist in dislodging and evacuating the intestinal entozoa; but, in addition to such an effect, they act upon the parasitical animals themselves, and by irritating and wounding them, oblige them to quit their hold. Mr. Rumsey (*Medico-chirurg. Trans.*, vol. ix.) has offered some interesting remarks upon the manner in which *Lumbrici* dispose themselves in the canal, and which will confirm the view taken of their expulsion. "The dissection of a subject," says he, "has shown me that they dispose themselves in the most curious

* There are four principal species of entozoa generated in the human intestines, *viz.* the *Tænia*, or tape-worm; the *Tricocephalus*, or *Trichuris*—*Ascaris Vermicularis*, (Ascarides,) and *Ascaris Lumbricoides*. Besides these, however, there are some others, rarely occurring, and hitherto imperfectly defined. I was very lately consulted by a naval officer, on his return from Chusan, and he informed me that a number of the troops had perished from worms, produced, as it was supposed, by the putrid water with which they had been supplied. I had no opportunity of examining them, but from the description I received, I do not believe they belonged to any of the species of *Entozoa* above enumerated.

and tortuous form, such as is best adapted to the exertion of their muscular power against opposite sides of their cylindrical abode, resisting by such means the effect of the propelling motion of the canal, and thus keeping their station. An illustration of this mode may be found in the art employed by a chimney-sweeper to counteract the effects of gravitation by pressing against opposite sides of the cylinder, in which he exerts his skill." The irritation produced by the mechanical anthelmintic prevents them from retaining this position, while the increased peristaltic motion causes them to be readily expelled.

345. The *Filings of Tin*, (Stanni Limatura,) or *Powdered, or Granulated Tin*, (Pulvis Stanni, D.,) have been long used as vermifuges. In combination with common salt, and other purgatives, it was employed by Paracelsus; Dr. Alston, however, was the first to bring it into general notice, and from his Lectures on the Materia Medica, we learn the manner in which he exhibited it. He gave as much as an ounce, in the form of electuary, for the first dose, and after three days, half that quantity was given; a brisk purgative was then administered, which generally brought away the worms. It is now, whenever given, employed in the divided doses of a drachm three or four times a day, for several days in succession, after which a purgative is prescribed. Its efficacy in expelling worms has been explained on other hypotheses than that of mechanical agency, *viz. upon the presence of Arsenic;* but if so, why should the *purest* specimens act with equal efficacy?* It has been supposed by others that it operates by generating *Hy-*

* Besides which, arsenic in its metallic state is not poisonous. As it is almost impossible to reduce the metal to a state of powder, without its becoming oxidized, M. Renault had recourse to its alloys for deciding the question; and he found that mispickel, (an alloy of iron and arsenic,) when given to the extent of two drachms, had no apparent effect; this result agrees with the conclusion of Bayen, in his work on Tin, and proves that the arsenic which may be contained in that metal cannot produce any medicinal effect, as it exists in its metallic state. (*Recherches Chimiques sur l'Etain, par Bayen et Charlard*, 1781.)

drogen, or Sulphuretted Hydrogen gas, in the *intestinal canal*, and thus poisoning the worm, an opinion which is said to receive support from the fact, that sulphur* enhances its efficacy; but this, again, is answered by stating that the worm is expelled alive. Another, and at one period a highly popular remedy for the expulsion of the *Ascaris Lumbricoides*, is the fetæ of the pods of *Mucuna Pruriens*, or cowhage. Like tin, they are exhibited in syrup or treacle; a dessert spoonful of such an electuary is given to adults, and a tea-spoonful to children, night and morning for three or four days, and a cathartic is then administered.

346. These mechanical remedies are now but rarely used, having been superseded by *Specific*, *Purgative*, and *Chemical* anthelmintics, upon each of which a few remarks may be necessary.

347. *Specific Anthelmintics.*—These substances destroy the worms by the action of a poisonous principle, of which there is a great variety. Bitters,† for example, appear to operate generally as a poison to these animals, while at the same time they give an increased tone to the organs of digestion, from the debility of which their generation would seem to arise. *Oil of Turpentine* unquestionably acts as a most virulent poison upon the *Entozoa*, especially upon the tape-worm, which it expels lifeless and livid. Tobacco has also been

* Guy's Powder of Ethiopia. This once celebrated remedy consisted of pure rasped tin, mercury, and sublimed sulphur, triturated together.

Blaine's Powder for the Distemper in Dogs. The basis of this nostrum is the *Aurum Mussivum*, or *Sulphuret of Tin*, and which has been said to be more efficacious in cases of tænia than the simple metal.

Mathieu's Vermifuge. This consisted of two distinct electuaries, the one for *killing*, the other for expelling the tape-worm. The former consisted of an ounce of tin-filings, and six drachms of the fern-root.

† It is a curious fact that bitters should be so essential to the well-being of the higher order of animals, as already explained, (83-84,) and yet prove so generally destructive to insects. Flies are almost immediately destroyed by an infusion of quassia; and Nature would appear to have protected the ear from the invasion of insects by providing an intensely bitter secretion.

proposed with a similar view, but its administration is attended with such danger as to render a trial of it, under any circumstances, unjustifiable. The root of the *Aspidium Filix mas* (the Male Fern) has already been adverted to as an ancient remedy of this kind (p. 64). The bark of the *Geoffroya Inermis*, or bastard cabbage-tree of Jamaica, in the form of a decoction, was introduced to notice as a specific vermifuge by Mr. Duguld of that island; and the powdered root of the *Spigelia Marylandica* (Indian Pink) has also found its advocates.

348. *Purgative Vermifuges.*—Under this head may be included the whole list of drastic medicines, *Calomel*, *Scammony*, *Jalap*, &c.* Gamboge, from its operation upon the stomach, deserves, however, especial notice as a remedy in tape-worm,

* Such is the composition of most of the nostrums sold for the cure of worms. They are generally dangerous and uncertain; and the method of exhibiting them in the form of lozenges (worm-cakes) is also objectionable, for the sugar and gum generating an acid, by being kept in damp places, may increase the acrimony of the mercury: besides which the calomel is frequently diffused very unequally through the mass, so that one lozenge may contain a poisonous dose, while others may scarcely possess any activity.

Ching's Worm Lozenges. These consist of two kinds of lozenges, the *yellow* and the *brown*. The former are directed to be taken in the evening, the latter the succeeding morning.

The Yellow Lozenges. Take of saffron ʒß, of water Oj, boil and strain; add of white panacea of mercury (calomel washed in spirit of wine) lb.j, white sugar 23lb.; mucilage of tragacanth, as much as may be sufficient to make a mass, which roll out of an exact thickness, so that each lozenge may contain one grain of *Panacea*.

The Brown Lozenges. Panacea ʒvii, resin of jalap lb.jß, white sugar lb.j, ix, mucilage of tragacanth q. s., each lozenge to contain gr.ss of *Panacea*.

Story's Worm Cakes. Calomel and jalap made into cakes, and coloured with cinnabar.

The Specific of Herrenschwand, which formerly excited so much interest in Germany, consisted of ten grains of gamboge, with twenty of carbonate of potass, although it has been stated that, on its being analysed by order of Elizabeth of Russia, there were also found in it both mercury and arsenic.

and it enters as an ingredient into many of the empirical compositions which are sold for that purpose.

349. In the cure of ascarides, the local application of the remedy frequently becomes necessary, in the form of clyster, and which acts both *mechanically*, by washing out the gut, and *medicinally*, by poisoning the animals. According to the experience of some practitioners, a strong decoction of the *Semina Santonici* proves most efficacious upon these occasions. A solution of common salt in an infusion of quassia I have found to act powerfully in such cases. Others have employed camphor rubbed down with oil; aloetic solutions have been likewise used with effect. Cold water, without any addition, is far from being inefficacious. Solutions of iron, such as the Tunbridge water, have been also employed with advantage. Lime water has the property of acting upon the mucus, in which this species of entozoa is always embedded, and may therefore very properly form an ingredient in such applications.

350. *Chemical Anthelmintics.* Such bodies as act upon the slimy secretions of the intestinal canal may properly be classed under this division; or those which act chemically by neutralizing acidities, of which the fixed alkalies, lime-water, and some of the preparations of iron may be adduced as examples. Cream of tartar has also, in some cases, the property of clearing the canal of its superabundant mucus, by exciting the exhalants to an increased action.

351. It is obviously essential, after having expelled the animals, and the nidus in which they are imbedded, that we should devise a plan of diet calculated to restore the digestive organs to a healthy action, and to preserve the secretions from morbid degeneration. Bitter *Tonics*, and gentle aperients, will therefore claim the attention of the practitioner.

DEMULCENTS.

352. Medicines which are capable of shielding sensible surfaces from the action of acrid matter, by involving it in a mild and viscid medium.

353. It cannot be denied that when these remedies admit of direct application, considerable benefit may arise; in the progress of a catarrh, we have all experienced the relief that may be occasioned by lubricating the fauces with demulcents which, by soothing the top of the trachea, quiets, by a kind of contiguous sympathy, the whole pulmonary structure. In certain states of intestinal irritation, the same remedies have afforded considerable benefit; and in ophthalmia, relief has been obtained by the application of a demulcent to the inflamed conjunctiva, by which it is defended from the irritation of the tears, for which purpose some practitioners have preferred the decoction of quince seeds, and have prescribed it in conjunction with the acetate of lead; such a combination, however, is very unchemical, as it forms a precipitate, and must invalidate its effects. The same decoction has also been strongly recommended as an application to erysipelatous surfaces; and it is well adapted for such purpose, since it is not so easily washed away from the part as ordinary mucilage. In uterine discharges, attended with an irritable state of the vagina, the decoction of oak bark may, upon the same principle, be advantageously combined with an infusion of linseed; but in parts beyond the reach of the first passages, and to which no fluid can arrive but through the medium of the secretions, it is very difficult to understand the principle upon which their beneficial operation can depend; and it seems, indeed, more probable that they act in such cases as simple diluents, for the process of digestion must necessarily deprive them of their characteristic viscidity. The administration of demulcent drinks in gonorrhœa is probably of no further service in assuaging the *ardor urinæ*, than an equivalent quantity

of pure water. I can state, as the result of experiment, that the urine undergoes no change, except in the relative proportion of its water, by the copious and repeated administration of mild mucilaginous drinks. Dr. Saunders has very justly remarked that the long list of *Ptisans*, *Decoctions*, &c., usually prescribed on these occasions, generally owe their virtues to the watery diluent itself.

354. The pharmaceutical applications of this class of medicines constitute not the least part of their value, by which we are enabled to introduce acrid substances into the stomach with safety and effect; but such services will more properly fall under our notice in the next division of the work.

DILUENTS.

355. Watery liquors which increase the fluidity of the blood, and render several of the secreted and excreted fluids less viscid.

356. There are certainly few remedies whose operation is more simple, obvious, or important; and yet there are scarcely any whose value has been more mistaken, or whose application has been so frequently perverted through the suggestions of false theory. Water is the universal beverage of animals, and the necessity of its supply is indicated by thirst, a sensation which, in excess, is borne with less tranquillity even than that of hunger; in certain morbid states of the body its presence is to be regarded as Nature's instinctive petition for copious potation; and yet how often has the prejudiced practitioner, under such circumstances, aggravated the pressure of disease, by adding the sufferings of Tantalus. In febrile affections, the irritation of thirst tends to keep up the disease, and hence diluents, besides the other beneficial effects which they may produce, must be regarded as important remedies. There are

also diseases of the alimentary canal which may be removed, and excrementitious impurities washed away, by the same agents. When water is conveyed into the intestines, it will have a tendency, by mixing with and diluting the biliary secretion, to diminish its acrimony, and thus to obviate a source of morbid irritation. The dilution of the chyme and chyle may also have a salutary effect, and favour the absorption of the finer and more nutritive parts by the lacteals, and thus expedite the numerous changes which they are destined to undergo. The blood itself is also modified in its fluidity, although it has been very truly observed that in the *healthy* system, or in one that is without any obstruction to the natural excretions, an unusual distension of the vessels cannot be produced, or at least long subsist, for it is evident that such an increased quantity of water in the blood will immediately pass off by one or other of the excretions; this effect, however, in itself renders the operation of diluents of signal service in the treatment of disease; in consequence, for instance, of their disposition to pass off by urine, they furnish valuable resources in affections of the urinary organs, allaying the pain of strangury, and the high irritation consequent upon an inflamed bladder. In a medicinal point of view, we shall hereafter be called upon to appreciate their importance as the carriers of certain principles to the organs of secretion and excretion. Something also may be due to their mechanical agency, in distending and enlarging the diameters of the capillaries; and when we consider the important part which these vessels act in initiating structural change, we shall be disposed to allow a just importance to every influence that can affect them. There cannot exist a doubt that many of the beneficial effects ascribed to mineral waters depend upon simple dilution.

357. It may be here necessary to offer a few observations upon the misapplication of this order of remedies. Dr. Davy found by experiment, that when an animal is bled to death, the last portions of blood are of a much lower specific gravity

than those which flow at the commencement, in consequence of the former containing more water, which it is to be inferred was derived, by the increased activity of the absorbents, from the mucous and serous membranes. Since, then, venesection promotes and accelerates absorption, (108,) it is clear that in inflammatory diseases, where we have recourse to blood-letting in order to diminish the volume of the circulating fluids, we ought not to suffer the patient to indulge in an unrestrained use of liquids, which he eagerly demands to satisfy a thirst which is probably the natural consequence of an increased absorption. In such cases it is often better to administer liquids in small divided doses, which will have the effect of moderating the thirst, without overloading the arterial system, and bringing back that tension and plenitude which it has been our object to relieve. These views are equally important to the surgeon, for they will guide him in the treatment of patients who have undergone operations, for in some cases it will be desirable to restore as speedily as possible the blood that may have been lost, while in others it may be equally advisable to adopt an opposite practice.

358. In the administration of watery diluents in fevers, it may be observed that its temperature should be attended to; as a general rule it may be laid down, that in the cold stage it should be *hot*, in the hot *cold*, and in the sweating *tepid*.

359. It cannot be denied that exorbitant potation has a tendency to produce fat, which may depend upon the vascular distention, and consequently diminished absorption thus occasioned. It has been explained on the supposition that water yields hydrogen by its decomposition; but it has been already stated (26) that we have no reason to suppose that it is ever resolved into its elements in the living system.

EMOLLIENTS.

360. Substances whose application diminishes the force of cohesion in the particles of the solid matter of the human body, and thereby renders them more lax and flexible.

361. According to this definition, which we derive from Dr. Cullen, the primary operation of emollients would appear to be purely mechanical, for they are insinuated into the matter of the solid fibre, and either diminish its density, or lessen the friction between its particles. This explanation will undoubtedly apply to those emollients which consist of unctuous bodies, and which are introduced by friction; but it is evident that the beneficial effects of *Cataplasms* and *Fomentations* cannot be so explained; for in these instances, none of the materials can be absorbed through the entire cuticle, and yet the relaxation and consequent ease which such warm applications produce on inflamed surfaces is very considerable, but it must be wholly attributed to the relaxing effects of warmth and moisture upon the extreme vessels of the surface, propagated by *contiguous sympathy* (45) to the deeper-seated organs.

LAXATIVES.

362. It having been frequently stated in the course of this work that certain bodies have the property of increasing the peristaltic action by operating *mechanically* upon the coats of the intestines, (115,) I thought it right to introduce, under the division of mechanical remedies, a class in which they might be arranged.

ALTERATIVES.

363. It is a question how far those remedies which have received the name of *Alteratives* can with propriety be included under any particular class; since every medicinal agent which has the power of effecting a change in the condition of the living body might be termed an *Alterative;* but the term is conventionally restricted to such as by a continued use gradually, and almost imperceptibly, correct disordered actions; in fact, the expression may be said to relate as much to the mode of exhibition, as to the particular nature of the remedy. Mercury may, perhaps, better deserve the specific appellation than most other remedies, since by its administration in small and repeated doses, we gradually increase the activity of the secreting organs, and imperceptibly restore healthy action; and since it exerts a powerful influence over the capillary circulation, in which structural changes commence, it offers the surest method of arresting those morbid processes which must ultimately lead to organic mischief.

PHARMACOLOGIA.

PART III.

ON THE

THEORY AND ART OF PRESCRIBING,

WITH ILLUSTRATIVE FORMULÆ.

"Res est maximi momenti in arte medendi, cum Formula in se considerata, possit esse profecto mortis vel vitæ sententia."

PHARMACOLOGIA.

PART III.

ON THE THEORY AND ART OF PRESCRIBING.

"Variorum mixtura novas sæpe vires generet, in simplicibus nequaquam reperiundas longe saluberrimas. Itaque hoc tantum moneo, prudentia opus esse in miscendo, nec inconsiderate quælibet cum quibuslibet componenda, nec ex singulorum ingredientium virtutibus virtutem compositi semper explicari posse."—GAUBIUS.

364. WHEN it is asserted that the arm of physic has derived new power and increased energy from the judicious intermixture and combination of medicinal substances, the physician is not to infer that he cannot fulfil many important indications by the administration of a simple remedy; nor is he to disregard the numerous chances of failure which are necessarily incurred by every complication not sanctioned by mature experience, or sound science. It is only contended that, in many cases, a single medicine may, by its union with others, not only act with greater certainty and less inconvenience, but that its sphere of influence may be thus more widely extended; or even its nature so modified, or entirely changed, as to give rise to a new remedy. It therefore becomes an object of paramount importance, in order that we may avail ourselves of all the resources which art can supply, to collect the scattered

facts which experience may have furnished, or science discovered; and so to classify them as to establish a methodical arrangement of the several objects to be attained by medicinal combination, and of the means by which they may be most readily and safely fulfilled. "It has been common to assert," says Mr. Whewell, "that facts alone are valuable in science, that theory, so far as it is valuable, is contained in the facts; and so far as it is not contained in the facts, can merely mislead and pre-occupy men; but it should be known that *facts can only become portions of knowledge as they become classed and connected;* that they can only constitute truth when they are included in general propositions." Deeply impressed with the importance of a sentiment thus happily expressed, and under a full conviction that the subject of medicinal combination has never received that share of attention which it merits, I have been induced to undertake the arduous task of inquiring into the several relations in which each article of a compound formula might advantageously, or otherwise, be situated with respect to the others; and had I required further encouragement for the prosecution of my plan, the observations of Dr. Powell would have afforded it, for he says, "I think it may be asserted, without fear of contradiction, that no medicine, compounded of five or six simple articles, has hitherto had its powers examined in a rational manner." But we cannot be surprised that so much obscurity and doubt should for ages have surrounded a subject which must necessarily require the aid of chemistry for its elucidation.

365. The practice of mixing together different medicinal substances, so as to form one remedy, may claim a very ancient origin, for most of the prescriptions which have descended from the Greek physicians are of this complexion. The uncertain and vague results of so blind a practice appear also to have been early felt, and often condemned; for even Erasistratus declaimed with great warmth against the complicated medicines which were administered in his time. The greater

number of these compositions present a mass of incongruous materials, huddled together without any apparent order or rational design; indeed, on examining the long and multifarious prescriptions of the Galenists of the seventeenth century, it would almost appear as if they regarded a medical formula as a problem in *Permutation*, the only object of which was to discover and assign the number of changes that can be made in any given number of things, all different from each other.

366. At the same time it must in justice be allowed that some of the earlier physicians entertained correct notions with regard to the use and abuse of combination, although their knowledge of the subject was of course extremely limited in its range, and imperfect in its application. Oribasus, a native of Sardes, in the fourth century, recommends in high terms certain combinations of *Evacuant* and *Roberant* medicines; and the remarks of Alexander Trallanus on a remedy which he exhibited in paralysis, serve to show he was well acquainted with the fact, that certain substances lose their efficacy when they stimulate the bowels to excess, for he cautions the practitioner against adding a greater proportion of *Scammony* to it; many, he observes, think that by so doing they increase the force of the medicine, whereas, in fact, they make it *useless* by carrying it immediately through the bowels, instead of suffering it to remain and be conveyed to the remote parts.

367. In modern Europe, the same attachment to luxuriancy of composition has been transmitted to within half a century of our own times; there are several prescriptions of Huxham extant which contain more than *an hundred* ingredients. I have already observed that all extravagant systems tend, in the course of time, to introduce practices of an opposite kind; this truth finds another powerful illustration in the history of medicinal combination, and it becomes a serious question, which it will be my business to discuss, whether the disgust so justly excited by the *poly-pharmacy* of our predecessors,

may not have induced the physician of the present day to carry his ideas of simplicity a little too far, so as to neglect and lose the advantages which in numerous cases, beyond all doubt, may be obtained by scientific combination. "To those," says Sir Alexander Crichton, "who think that the science of medicine is improved by an affected simplicity in prescribing, I would remark that modern pharmacopœias are shorn so much of old and approved receipts, on account of their being extraordinary compounds, as to be almost useless in some cases."

368. If we required evidence, beyond our daily experience, of the influence reciprocally exerted between different medicinal principles in the production of new or modified compounds, we might receive it from the hands of Nature, for the theory is amply justified by the state of combination in which certain active principles are found in our more efficient vegetable remedies, while the practice founded upon it is sanctioned, as it were, by Nature's own prescriptions; enter but her laboratory, and you will soon be satisfied that several of her more potent remedies do not owe their valuable powers to any one specific ingredient, but to the combined or modified energies of various and sometimes opposite principles. This view of the subject opens an interesting and unexplored field of medical and chemical research, while it will at least afford a lesson of caution to those who too inconsiderately seek to isolate the virtues of a plant, by extracting the principle upon which they may be supposed entirely to depend. How many vegetables do we possess, in which the permanent tonic quality of bitterness exerts its influence in union with the more transient stimulus of an aromatic principle? Indeed, there is a series of such natural compounds; commencing with those that are simply bitter, such as *Quassia*, we gradually proceed through the different species, each blending as we advance an increasing proportion of aroma, until we arrive at those in which the aromatic quality greatly preponderates, while in some there is superadded a principle of astringency,

as in *Cinnamon*. Before the discovery of the salifiable bases of Peruvian bark, that substance was generally regarded as combining within itself the properties of *bitterness*, *astringency*, and *aroma*, and it is still a question how far *Quina*, or *Cinchona*, fulfils all the conditions of the bark; it is, for instance, generally believed that the powder of bark is more efficient in cases of gangrene; and experience has shown that, on many occasions, the sulphate of quina may be increased in efficacy by the addition of some aromatic; be this as it may, the fact of bitterness, astringency, and aroma, having been recognised in the bark, very naturally suggested the probability of our being able to produce an artificial compound that might emulate its effects; and to a certain extent the idea appears to have been realised, for we are told by Dr. Cullen that he frequently succeeded in curing an intermittent by a combination of *Galls*, *Tormentilla*, or *Oak Bark*, with *Gentian*, when neither bitters nor astringents, separately, produced the least impression; and I was informed by the late Dr. Harrison that, in the Horncastle Dispensary, of which he was for several years the physician, he never employed any other remedy for curing the ague of Lincolnshire than equal parts of Bistorta (astringent) and *Calamus Aromaticus*, (bitter and aromatic,) neither of which plants, *separately*, ever produced the least benefit in such cases. Berzelius attempted to form a compound of this description by adding to the bark of the *Ash* some *Tormentil Root* and *Ginger;* and he observes, that according to the experiments of his friends, it seemed to cure quartan agues. In the aromatic barks and woods, such as those of *Canella*, *Orange Peel*, *Sassafras*, &c., and in the root of *Serpentaria*, the aromatic principle is combined with a bitter ingredient; an union which proves of singular service in the formidable bowel complaint so common in tropical climates.

369. Again: can it be said that we receive from the salts of morphia all the beneficial effects of opium? In some cases I have found the former incapable of checking diarrhœa, and

mucous discharges, when the latter has proved immediately effectual. The one will frequently fail in procuring sleep, which will be readily induced by the other. Morphia is also far less disposed to excite perspiration than opium. Were all the powers of opium concentrated in its morphia, this active principle ought to have ten times the power which it is known to possess.

370. The great superiority of the hop as an ingredient in our malt liquor depends upon the fact of its containing within itself several distinct and independent elements of activity, which the other bitter herbs that have at different times been employed as its substitute do not appear to possess. The philosophy of its operation is involved in some little doubt, but it would seem that it contains a bitter principle, (*Lupulite*,) which imparts to the beverage a tonic quality and an agreeable flavour; while at the same time an aromatic ingredient (*Volatile Oil*) adds a warm and stimulant property, and tempers the bitterness; and also, according to Liebig, has the effect of modifying the action of the fermenting ingredient, (*Yeast*,) although I am disposed to refer this latter effect to its astringent matter, (*Tannic Acid*,) which may precipitate the gluten, and thus remove the active principle of its fermentation.* Every attempt, therefore, to substitute an ordinary bitter for that of the hop must necessarily fail, unless a compound be so artfully constructed as to contain, in due proportions, the essential principles of bitterness, aroma, and astringency; and it is possible that the chemist may, by a more subtle analysis, hereafter effect his purpose.

371. Rhubarb is another medicinal plant which may be brought forward in illustration of this subject; in this in-

* If this be the fact, we perceive why English hops that contain more *Tannic Acid* than those imported are found to be superior preservatives of beer. I have been informed that in Westmorland and Cumberland, water from the peat bogs is employed in the breweries, the effect of which, from the astringent matter held in solution, is to render the hop less necessary for the preservation of the beer.

stance, nature has presented us with a singular and most important union of medicinal powers,—that of an astringent with a cathartic property—virtues which we might, without the light of experience, have pronounced as incompatible with each other; and yet we find that the property of astringency never interferes with, or opposes, the purgative quality, since the former does not display itself, unless indeed the substance be given in very small doses, until it has ceased to operate as an aperient.

372. In *Colchicum* there would appear to co-exist *Sedative* and *Cathartic* virtues; the former manifesting their effects more especially upon the circulation; the latter upon the hepatic system, producing stools of a bilious character.

373. I fully appreciate the danger of pushing such analogies too far; in the support of a favourite theory we must be cautious how we explain away, or overlook facts that appear to oppose its truth, or strain and coax them so as to suit our purpose. A theory is of no other use than that of comparing its deductions with the results of observation and experience.

374. In all other branches of science, nature has ever been a kind and steady guide, and in that which now engages our attention there can be no doubt, if she be rightly interpreted, that her lessons will be equally instructive. It is said that by observing the means which she adopts for preventing the diffusion of light in the eye-ball, Euler derived an important hint for the improvement of the telescope; and more lately, the structure of the crystalline humour has been successfully imitated by Dollond, in the invention of achromatic lenses. The idea of purifying our water by filtration was suggested by Nature herself, for all springs arising through sand and gravel are thus purified during their passage; hence it occurred, that if water loaded with muddy and unwholesome matters were passed through a factitious bed of sand, or through porous sandstone, it might be clarified and rendered fit for use; while the study and investigation of its soluble earthy and mineral contents have suggested saline combinations, of much

value as remedies. To what do we owe the most material improvement in the manufacture of paper—that, for instance, of obtaining toughness by means of long fibres? to no other instructress than Nature, for by imitating the process of the wasp we have learnt to perfect our own. The plan of tunnelling through the bed of the Thames was suggested to the eminent engineer by the operation of the *Teredo*, and the same happy observation of the wisdom of Nature led our distinguished countryman, Mr. Watt, to deduce the construction of the *flexible water main*, from the mechanism of the lobster's tail. From the examination of the composition of milk, the physician at once obtains a model of a perfect alimentary compound; it is designed and prepared expressly by the hands of Nature for food, and is therefore, as Dr. Prout denominates it, a kind of *prototype* of nutritious matters in general; for, says he, it is a mixture of water, saccharine principle, albumen, and oil; and these are the four great "*staminal principles;*" and to form an alimentary compound, adapted for the support of the higher order of animals, a mixture of three at least, if not of all, is essential. It was wisely said by Lord Bacon, that "man should observe all the particular workings of Nature, and meditate which of those may be transferred to the arts." May we not, then, by carefully analysing the compound productions of nature, and observing the influence which each element exerts in the combination, as exemplified in her more valuable remedies, reasonably entertain the hope of deriving important hints for improving the arrangements of art, while art, in return, may thus be enabled to modify and adapt to particular purposes the products of Nature; but in every attempt to accomplish such objects, we must be careful how we infringe her laws, since it is only by obeying Nature that we can expect to command her services.

AN ANALYSIS

OF

THE OBJECTS TO BE ATTAINED BY MIXING AND COMBINING MEDICINAL SUBSTANCES.

375. Compound Medicines have been classed under two divisions, *viz.* Officinal and Extemporaneous preparations. Not that the distinction has any existence in principle, but may be adopted as a measure of practical convenience.

376. Officinal Preparations are those for which formulæ are introduced into the pharmacopœias of different countries, and are therefore supposed to be always ready for use* in the laboratories of the dispensing chemist; an arrangement which is not only calculated to insure uniformity in the strength and composition of such articles, but to abridge the labour and to economise the time of the prescriber, while to the less experienced practitioner they are acceptable as standards of composition, and as safe and efficient models for his guidance and instruction; at the same time he is not to consider himself as thus restricted to statutable limits; he is not to regard the formulæ as immutable receipts, beyond which nothing can be required or allowed, for since every case of disease will be found to vary with individual circumstances, so must every remedy be modified to meet such variations, and hence the necessity of

EXTEMPORANEOUS, OR MAGISTRAL FORMULÆ.

377. These are said to be "*extemporaneous*," since they are constructed by the practitioner on the instant, "*ex tempore*,"

* This is not to be understood *literally*, that every officinal preparation is to be kept in store by the dispenser; such as are perishable, as many infusions and mixtures, must be necessarily made as they may be required.

under the vivid impressions received by the recent investigation of the symptoms of each case, and they may be either arrangements altogether new, or officinal preparations with additions or modifications; of which many examples will be found in the formulæ appended to this work. Too much importance cannot be assigned to the art that thus enables the physician to adapt and graduate a powerful remedy to each particular case, by a prompt and accurate prescription; without this knowledge the practitioner of the nineteenth century, with all the collateral aids of modern science, and imbued, as he may be, with the best principles of pathology, will be as feeble in the chamber of sickness as the physicians of ancient Egypt, who were obliged by the laws to follow with servile exactness the unvarying mandates of their medical code; and let me here warn the junior practitioner against the too common practice of providing a number of *ready-made* and *second-hand* prescriptions. If he prescribes upon truly scientific principles, he will rarely in the course of his practice compose two formulæ that shall, *in every respect*, be perfectly similar, for the plain reason that he will never meet with two cases exactly alike. Now let me ask what constitutes the essential difference between the true physician and his counterfeit—between the philosopher and the empiric? simply this—that the latter exhibits the same medicine in every disease, however widely each may differ from the other in its symptoms and character; while the former examines, in a spirit of philosophic analysis, all the existing peculiarities of his patient and of his disorder, and being thus led by a sagacious induction to an estimate of his vital powers, and to a knowledge of the nature and condition of the *peccant* organs, he graduates and adapts with a sound discretion, and with a correct judgment of his agents, such means as may be best calculated to control and correct their morbid condition. Strange and almost incredible as it may appear to those not initiated in the mysteries, there are not a few who are in the daily habit of prescribing *blue pill*, *iodine*, *creosote*, or some such

ascendant remedy, in diseases of the most adverse tendency, and under circumstances of the most opposite character. To such practitioners the following fable of Camerarius* may not be uninstructive. "It perchance happened that an ass and a mule went laden over a brook, the one with wool, the other with salt; the mule's pack became wet by accident, and much of the salt was dissolved, his burthen therefore was lightened, and the animal was much eased. Upon which he told the ass, who wished to speed as well as his neighbour, to wet his pack in like manner at the next water; this the ass did not neglect to perform, when he found, to his sorrow, that it became so much heavier he was unable to proceed on his way." The practitioner who indiscriminately deals out a remedy is not less improvident than the mule, who, having discovered the efficacy of water in his own case, blindly recommends it to his neighbour, without ever inquiring how far the circumstances of each might resemble or differ from those of the other.

378. A prescription, therefore, ought, in the strict sense of the term to be *extemporaneous*—"*Idem calamo quod in mente.*" The bundle of ready-made receipts, in the hands of the routine practitioner, is but a well-equipped quiver on the back of an unskilful archer.

379. The objects to be attained, and the resources furnished by Medicinal Combination, together with the different modes of its operation, and the laws by which it is governed, appear to admit of the following classification.

* Emblems 55, Cant. 2.

I.

TO PROMOTE THE ACTION OF THE BASIS, OR PRINCIPAL MEDICINE.

A. *By combining several different forms, or preparations of the same substance.*

380. The utility of such a combination is obvious, whenever we desire the full and general effects of ALL the principles of a medicinal substance in solution; thus, where a vegetable tonic is required, and the stomach will not bear the exhibition of the gross powder, it will be eligible to conjoin the decoction, infusion, or extract, with the tincture, in the same formula; numerous examples of which the practitioner will find in the appended prescriptions. The necessity of such a combination may be expressed by the following canon. *Whenever the chemical nature of the medicinal substance will not admit of the full solution of all its active principles in any one solvent, and its exhibition in substance is ineligible.*

381. Practitioners, probably without having reasoned upon the theory, have very generally adopted the practice of combining the different solutions of the same substance, for in the extemporaneous prescriptions of our most practical physicians we commonly find, that the decoction or infusion of a medicinal vegetable is thus quickened by a certain portion of a corresponding tincture. Our pharmacopœia, it is true, affords but a solitary example of this kind, (*Infus. Armoraciæ comp.*,) for the obvious reason that such additions should be left to the discretion of the extemporaneous prescriber.

382. There are cases in which we impart, by this species of combination, an increased solubility to the basis, or element of activity; thus, in the *Liquor Potassii Iodidi Compositus*, the Iodine is rendered soluble by the *Iodide of Potassium*, forming a compound termed the *Iodureted Iodide of Potas-*

sium. Whenever the tincture of Iodine is prescribed, it should be remembered that, without such an adjunct, it is precipitated by almost every vehicle in which it can be administered; in consequence of which it may produce an injurious irritation in the alimentary canal.

B. *By combining the basis with substances which are of the* SAME NATURE, *that is, which are individually capable of producing similar effects, but with less certainty or energy than when in combination with each other.*

383. Dr. Fordyce, in a valuable paper, published in the second volume of the Transactions of the Medical Society, in the year 1789, investigated this subject with much perspicuity and success; and it is to be regretted that this memoir should have terminated with the investigation of *similar* remedies, that is to say, of those which produce upon the body similar or analogous effects, and that he should have passed over, without a notice, the very considerable advantages which may be obtained by the combination of such medicines as possess *different,* or even *opposite* qualities. We are, however, unquestionably indebted to him for having been the first to establish the important generalization, that *a combination of similar remedies* will produce a more certain, speedy, and considerable effect, than an equivalent dose of any single one.*

384. It does not appear that this law of medicinal combination was known to any ancient physician, although numerous analogous articles were empirically introduced into their pre-

* The practitioner is called upon to receive conventionally the term "*similar.*" Many of those remedies which we are at present bound to consider *similar,* will no doubt require to be transplanted into other classes, as the progress of knowledge shall further elucidate their modes of action. In the present attempt to teach the theory of combination, I have endeavoured to reduce the several propositions which it embraces to the greatest degree of generality which our present knowledge will allow.

scriptions. The earliest allusion to it that I can find is by Valisnieri, the favourite pupil of Malpighi, who filled the medical chair at Padua in 1711, nearly ninety years before Fordyce published his valuable memoir; but he does not attempt any generalization of the subject; he merely states as the result of careful experiment, that twelve drachms of *Cassia-pulp* are about equivalent in purgative strength to four ounces of *Manna;* and yet, says he, if we give eight drachms of the former in combination with four drachms of the latter, we obtain double the effect! How, asks the professor, can this possibly happen? surely the very contrary ought to obtain, since four drachms of *Cassia* are much more than equivalent to an equal weight of *Manna;* the strength of the former being to that of the latter as eight to three? Numerous isolated statements of the same tendency might be adduced, but they cannot invalidate the claims of Dr. Fordyce, as being the first who generalized the fact, and applied it with success to practice; thus Diemerbroeck, in his notes upon the *Theriaca Andromachi*, observes that the composition is more efficacious from the concurrent powers of so many ingredients "*alike in virtue;*" and Quincy, in his "Lectures on Pharmacy," which were published by Dr. Shaw in 1723, says, "Those fœtid gums which are generally prescribed in hysteria, as *Ammoniacum*, *Galbanum*, &c., may be conjoined with advantage, because from a concurrence of properties they all conspire to the same end." The truth of this principle must have been continually felt by every practitioner who had diligently observed, and carefully compared, the different effects of his prescriptions.

385. Narcotics will often more readily fulfil the intention of allaying irritation and pain, when composed of several such medicines, than when they consist of any single article, even should its doses in this latter case be relatively greater. See *Formulæ* 19, 20, 21.

386. Bitter Tonics may also be thus exalted in efficacy, and rendered less disposed to oppress the languid stomach;

although I am well aware that, in many such cases, the beneficial effects of the combination admit of explanation upon a different principle; we may, for instance, consider the compounds as consisting of medicines differing from each other in their composition, and producing by their union an agreeable assemblage of bitter, astringent, and aromatic ingredients. Dr. Heberden, in proposing the administration of bitter stomachics in gout, advocates the propriety of uniting in one formula several of such articles. "*At ne forte unum aliquod privatim sit nauseosum, optabilius erit pulverem ex tribus aut pluribus componere.*"

387. Exhilarants,—Excitants, or Aromatic Stimulants. There are, probably, no remedies which receive greater mutual benefit by intermixture than the individuals which compose this class; for they not only thus acquire increased force and efficacy, but at the same time they lose much of their acrimony; if, for instance, any one spice, as the dried capsule of the *Capsicum*, be taken into the stomach, it will excite a sense of heat and uneasiness; a similar effect will follow the ingestion of a quantity of *Black Pepper*, but if an equivalent quantity of these two stimulants be given in combination with each other, no such sense of pain is produced, but on the contrary, a pleasant warmth is experienced, and a general glow is felt over the whole body; and if a greater number of spices be joined together, the chance of pain and inflammation being produced will be still further diminished. The truth of this law is strikingly illustrated, as Dr. Fordyce has observed, by that universal maxim in cookery, *never to employ one spice if more can be procured.* The object being in this case not only to please the palate, but to enable the stomach to bear a larger quantity of food without nausea, or to correct the indigestible nature* of certain aliments. It is upon the same

* Such was the nature of the *Mustacea* of the Romans, which were a species of cake, used at weddings, and which consisted of meal, aniseed, cummin, and several other aromatics; their object being to prevent or remove the indigestion occasioned by a too great indulgence at the mar-

principle that the leaves and seeds of the *Umbelliferæ* have been so long employed with success to correct and soften the acrid qualities of the onion tribe ;* thus is the disagreeable odour of the breath, after the ingestion of onion, best counteracted by *Parsley;* and if *Leek* or *Garlic* be mixed with a combination of different aromatic ingredients, its virulence will be greatly subdued and mitigated. This same principle finds an illustration of its importance in the following preparations of our pharmacopœia, viz.—*Pulvis Cinnamomi Compositus; Infusum Armoraciæ Comp.; Infus. Aurant. Comp.; Tinctura Lavendulæ Comp.; Tinct. Cinchonæ Comp; Confectio Piperis Nigri; Confect. Rutæ;* and the *Confectio Opii,* the scientific substitute for the once celebrated "*Mithridate,*" or "*Theriaca.*" See also *Formulæ* 1, 2, 3, 4, 6, 12.

388. The local action of stimulants would also appear to fall under the same law; and perhaps the origin of the popular custom, so long observed, of mixing together the varieties of snuff, may thus receive a plausible explanation; certain it is, that by such combination the harsh pungency of each will be diminished, and the odour rendered more mellow and agreeable. The same principle will direct the formation of safe and efficient stimulating plasters and lotions; the *Emplastrum Galbani* of the London, and the *Emplast. Aromaticum* of the Dublin Pharmacopœias, will afford examples. For the same reason, the *Cataplasma Sinapis* is rendered more active by the addition of the scrapings of horse-radish; and it may be presumed that the *Compound Plaster of Cantharides* of the Edinburgh College was suggested by a similar theory.

389. Astringents follow the same law, *e. g. Liquor Aluminis Compositus.* See also *Form.* 55—60.

riage feast. It must be acknowledged that such a compound was more likely to effect its purpose than the modern *Bridecake* to which it gave origin. (Cato de R. R. c. 121.)

* A fact which did not escape the notice of the husbandman of Virgil—

"Allia, serpyllumque, herbas contundit olentes."

Eclog. ii. *lin.* 11.

390. Emetics are certainly more efficient when composed of *Ipecacuan.* and *Antimony*, or *Sulphate of Zinc*, than when they simply consist of any one of these articles. See *Form.* 80—82.

391. Antispasmodics.—The co-existence of several bodies of this class is marked by an efficacy not to be ensured by the exhibition of any one of them *singly*. See *Form.* 30, 31, 33, 34.

392. Cathartics not only acquire a very great increase of power from the co-existence of analogous medicines, but they are thus rendered less harsh and irritating in their operation. The *Extractum Colocynthidis Compositum* affords an excellent example of a compound purgative mass being much more active, and less liable to irritate, than any of its components separately taken. In the composition of the *Pilulæ Rhei Compositæ*, we have another similar example; and in the *Pulvis Scammonii Comp.* the scammony is greatly aided in its operation by the extract of jalap. Additional examples are furnished by the following *Formulæ*, 94, 95, 96, 102, 106, 108.

393. In many cases, the fact of purgatives thus accelerating and correcting each other's operation may be explained by considering them as substances endowed with different powers, as already stated, (114,) and which will afford matter for future consideration in the third division of this essay. It may be a question whether the great activity of certain mineral waters, compared with the small amount of their active ingredients, may not in some measure depend upon the co-existence of different salts of a purgative nature, although much is, no doubt, to be referred to the state of dilution in which they exist.

394. Diuretics.—With respect to this class of agents, it may be observed, that *whenever a medicine is disposed to produce effects different from those we desire, its combination with similar remedies will always be eligible;* by which the action of the basis may, as it were, be directed or fixed. On this

account diuretics are always more efficacious when in union with each other, since the individual substances are not only uncertain, but perverse in their operation, and disposed to produce diaphoretic and other contrary effects; hence it is highly expedient to exhibit them in combination, taking care that they be compatible with each other in their physiological actions. See *Form.* 122, 123, 124, 125, 126, 127, &c.

395. Diaphoretics.—Our maxim, "*Vis Unita Fortior*," applies with equal truth to this class of remedies. See *Form.* 138, 139, 140, 141, 142, 143.

396. Expectorants.—More is frequently to be gained by the co-operation of these remedies than can be obtained by the separate articles. In the compound squill pill, the *Ammoniacum* imparts additional activity to the basis, while the *Ginger* assists as an appropriate stimulus. See also *Form.* 144, 145, 146.

397. Demulcents do not appear to obtain any other benefit from combination with each other than occasionally a convenience and efficacy in application, arising from a suitable degree of consistence and solubility, as will be more fully explained under the consideration of *Trochisci*, or lozenges.

398. In chronic affections of the mucous membrane of the bladder, Dr. Prout says that the effects of balsamic remedies are frequently more decided when conjoined with each other; thus the *Infusion of Diosma* may be often advantageously combined with small quantities of the *Chian Turpentine*, or *Cubebs*, or even *Copaiba*.

399. The operation of the law, which has thus formed the second object of our inquiry, will be found, like every other to be hereafter examined, to have a natural and well-defined limit; it is easy to perceive that, by multiplying the number of ingredients too much, we shall either so increase the quantity and bulk of the compound, as to render it nauseous and cumbersome, or so reduce the dose of each constituent, as to fritter away the force and energy of the combination.

400. The propriety of combining *several* stimulants of the

diffusible class in *one* formula, has been questioned on different grounds. Dr. Chapman, in his work on Therapeutics, adduces some arguments on this point which, although they fail in establishing his general position, certainly suggest an important exception to the practice in question; "By directing," says he, "stimulating remedies *singly*, we shall economise our resources in many lingering diseases." The justness of this statement must be admitted to its fullest extent, and practitioners will, on certain occasions, do well to act in conformity with the views that suggested it; for instance, in the feeble forms of protracted fevers, where the indications are to be met with the continued action of stimulants, it will certainly be salutary to alternate the use of *Camphor*, *Ammonia*, and other remedies of a similar nature, in preference to presenting them all at once in combination, so that the system may not lose its susceptibility by the continued impression of the same stimulant; the same motive should induce us, on particular occasions, to employ in succession different narcotics, for each of them affects sensibility in its own peculiar manner. Majendie goes so far as even to assert that, by varying the *different* preparations of the *same* narcotic, we shall be better able to keep up its action, without an increase of its dose. The nervous system, as Richerand has justly observed, may be compared to a soil rich in different juices, and which requires the cultivator to plant the germs of a diversified vegetation to develope the whole of its fecundity; and therefore to insure a perpetual return, it will be right to sow a succession of different seeds. Hoffman has also offered us some advice upon this subject; he cautions us, in the treatment of chronic diseases, to suspend the administration of remedies at intervals, and afterwards to resume them, lest the system should become *habituated*, and ultimately *insensible*, to their influence. Galen, in directing a treatment for the cure of old persons, is influenced by a similar theory: "In case an old man should continue costive for two days, he ought to take some aperient on the third; nor should he continue the

same medicine, but change it now and then, lest *by becoming habitual it should lose its effect;*" a practice which is adopted by every intelligent practitioner of the present day.

401. But there remains for our investigation a still more important precaution with respect to this law of medicinal combination; that, in combining substances in the manner, and for the object just related, the practitioner should be well satisfied that their medicinal virtues are in reality *practically* similar, or at all events that they are not medicinally inconsistent with each other, or he will fall into errors of the most fatal tendency. I confess that I have so frequently and earnestly urged this truth, that nothing but its extreme importance could justify its repetition; my apology, however, may be shortly expressed in the words of Seneca, "*Nunquam nimis dicitur quod nunquam satis dicitur.*" In order to establish practical similarity, *the operation of a medicine must be found by experience to continue similar under every condition of the human body; and it must, moreover, owe such similarity to modes of operation which are physiologically compatible with each other, and consonant with the general plan of cure.* We have agents that produce diaphoresis by their stimulant, and others by their relaxing properties; we cannot be said to err when we designate each of such bodies a diaphoretic, but they are not *practically similar*, since they require for their successful operation different states of the living system. Let us direct our attention to the history of Diuretics (127) for a further illustration of this most important truth; thus *Squill, Calomel, and Digitalis*, are each powerful diuretics, but nevertheless they cannot be considered *similar* remedies, since *Digitalis* may fail altogether in its effects in the very cases in which *Calomel* and *Squill* will succeed; and *Squill* may prove inert when *Digitalis* will be found to produce powerful effects. This arises from their modes of action being dissimilar, and consequently requiring for their success different states of the living system. Squill, it would seem, acts *primarily* upon the urinary organs, by stimulating the secreting vessels of the kidneys; *Mercury*,

on the contrary, acts *primarily* on the absorbents, and *secondarily* on the kidneys; whereas *Digitalis* produces its effects by diminishing arterial action, and increasing that of absorption. Dr. Blackall, in his "Observations upon the Cure of Dropsies," has offered some remarks so valuable in themselves, and so illustrative of this important subject, that I shall take leave to quote the passage. "Many physicians," he observes, "are fond of combining *Squill*, *Calomel*, and *Digitalis*, as a diuretic in dropsy, (*Form.* 136,) a practice unsafe, and not very decidedly possessing the merit of being consistent. *Digitalis* greatly depresses the action of the heart and arteries, and controls the circulation; and it seems most unreasonable to believe that its curative powers can be independent of such an effect; on the other hand, *Mercury*, if it does not pass off quickly, is always exciting fever and hardening the pulse; speaking from experience, where the urine is coagulable, and *Digitalis* agrees, both the others are, often at least, positively injurious. On the contrary, where the urine is foul, and not coagulable, and *Squills* with *Calomel* render service, I have on that very account made less trial of *Digitalis*, and cannot therefore speak from much experience."

402. I have already observed that the individual medicines which compose the class of Diaphoretics, vary considerably with regard to their primary operation; thus, in the cure of intermittent fevers, diaphoretics are useful both in the paroxysm and during the intermission; in the first case they shorten its duration, in the second they support the tone of the extreme vessels, and prevent its recurrence; but in these opposite states a very different kind of diaphoretic is required. To fulfil the first indication, a cooling and relaxing one is called for; to answer the second, the stimulating diaphoretic is exacted; the one may be said to *solicit*, the other to *extort*, perspiration.

403. Emmenagogues also can only be regarded relative agents, since the suppression of the catamenia may depend

upon, or be connected with, very different states of the body; in some cases with a diminished, and in others with an increased, state of excitement. Boerhaave has observed that it is a most dangerous error to ascribe all the diseases of young females to a retention of the catamenia, which often do not appear because the patients are disordered from other causes. If, therefore, we were to attempt a combination of the several medicines which have gained reputation as *Emmenagogues*, it is very obvious that we should bring together an assemblage of discordant remedies; nor would the physician be less in error, were he to combine EXPECTORANTS without a due regard to their modes of operation, as must appear evident upon the inspection of their classification at page 230.

404. The class of ANTISPASMODICS may likewise embrace remedies of the most opposite tendency, for spasm, as we have seen, (72,) may occur under the most opposite circumstances—in an extreme condition of weakness, as in certain nervous affections, and in a highly-excited state, as in cholic, &c.; it is hardly necessary, therefore, to point out the mischief that must arise from the fortuitous and indiscriminate intermixture of the individual substances which are unavoidably classed under a general designation. *Bark* and *Steel* are also too often indiscriminately used as *Tonics*. "In dropsy," says Dr. Blackall, "they are far from being equivalent remedies, the former being infinitely to be preferred after the dropsy of young persons of acute disease and of sound stamina; the latter being suited to a vitiated rather than to a feeble habit, and indicated more by a pale sallow complexion, and a want of red colour in the blood, as especially shown by the paleness of the lips than by any other signs; but enough has been said to satisfy the inexperienced practitioner, for whose instruction these observations have been offered, that the terms employed to denote the different classes of remedies can only be relative, expressive of effects which are alone produced with reference to a certain state of the living body; and as this necessarily varies in different conditions of health and

disease, it follows that medicines are convertible agents, and that when we attempt to institute general rules with respect to their administration, without taking into account the circumstances of the patient upon whom they are to operate, we shall be baffled by frequent disappointment. We may say of medicines what Van Swieten said of diet, "To assert that such or such a thing be wholesome, without a knowledge of the habit of the person for whom it is intended, is like a sailor pronouncing the wind to be fair, without knowing to what port the vessel is bound." So fully was Boerhaave impressed with this truth, that he exclaimed, "*Nullum ego cognosco remedium, nisi quod tempestivo usu fiat tale.*"

405. Although medicines which produce the same ultimate effects, by modes of operation obviously different, cannot be considered SIMILAR, in the sense affixed to the term in the present section; yet if these different modes of operation be not physiologically incompatible with each other, the union of such remedies may not only be admissible, but even useful, the consideration of which will offer itself as a subject of inquiry in a subsequent section (*viz.* III. A).

C. *By combining the* BASIS *with substances of a* DIFFERENT NATURE, *and which do not exert any chemical influence upon it, but are found by experience to be capable of rendering the stomach, or system, or any particular organ, more susceptible of its action.*

406. It will be readily admitted that there may exist conditions of the body, and peculiar states of its several organs, which render them more or less susceptible of remedial impressions; and if it can be shown that the administration of certain stimulants are capable of arousing their dormant energies, and of recalling or exalting their wonted excitabilities, it must follow that the medicinal combinations which we have now to examine will receive the sanction of theory, and the approbation of experience. In diseases attended with

diminished sensibility of the stomach, as in cases of intermittent and other fevers, *Capsicum* and different spices become powerful adjuncts to the bark and other remedies, the operation of which is thus greatly promoted. In some cases of inirritability of stomach, the addition of a small quantity of opium will impart efficacy to a remedy otherwise inert; an emetic will often be thus rendered more active, as I have frequently witnessed in my practice. In some states of mania, and affections of the brain, emetics will wholly fail, unless the stomach be previously influenced and prepared by a narcotic.* I have often also found that the system has been rendered more susceptible of the influence of mercury by its combination with antimony and opium.† So, again, when the system is in that condition which is indicated by a hot and dry skin, squill will fail in exciting expectoration; but administer it in conjunction with ammonia, and in some cases with *Antimonial Wine* and a *saline draught*, and its operation will be promoted. As a diuretic, *Squill* is by no means active, when singly administered, but *Calomel*, or some mercurial, when in combination with it, appears to direct its influence to the kidneys,

* It has been stated under the history of emetics, (101,) that in cases of profound intoxication, or in those of violent wounds and contusions of the head, vomiting will not take place, however forcibly the stomach may be goaded by an emetic; whereas if the brain be less profoundly affected, as by incipient intoxication, or by a less violent blow on the head, its irritability, instead of being paralysed, is so far increased that vomiting will be excited by the slightest causes. Just so is it with respect to narcotics, a powerful dose so paralyses the nervous system, that the stomach cannot be made to eject its contents, as every one must have observed in cases of narcotic poisoning, while smaller doses, like lesser injuries of the head, dispose the stomach to sickness.

† It would even appear probable that in some cases mercurial influence has been renewed, after its subsidence, by doses of opium; a remarkable instance of this kind is related in Hufeland's Journal, (*vol.* ix.,) in which an old woman is said to have fallen into a considerable salivation after every dose of opium. She had previously applied to a physician for an extensive ulceration over her body, and had taken a considerable quantity of mercury, but the effects had subsided until renewed by the opium.

and in some unknown manner to render these organs more susceptible of its influence,* (see *Form.* 135, 136.) In like manner, *Antimony* would seem to quicken the operation of saline purgatives, (*Form.* 86,) *Opium* to increase the sudorific powers of *Antimony*, (*Form.* 137, 139, 140,) and *Ipecacuan* to promote the purgative operation of *Jalap;* indeed, Dr. Aikin goes so far as to assert that fifteen grains of the latter, when combined with two or three of the former, will purge more than double that quantity of jalap, when administered without such an adjuvant.

407. In certain disordered states of the alimentary canal, there exists such an abundance of morbid mucus, as to defend the alimentary membrane from the due action of a medicinal substance; under such circumstances, Dr. Annesley, and more recently Mr. James Morgan, have shown, by numerous satisfactory cases, that *Bitartrate of Potass*, by the effusion of fluid it excites from the exhalants, becomes an important adjunct. *Antimonial Preparations*, which have failed in exciting emesis, have by such a combination been rendered active. For the same reason, *Jalap* may be greatly exalted in activity; in some cases where the simple powder has been powerless, the *Pulvis Jalapæ compositus* of the pharmacopœia has been found active. As mucus generally predominates in worm cases, it may be judicious to introduce the *Bitartrate of*

* Sir Gilbert Blane has advanced an ingenious hypothesis to explain the cause of the fœtid breath of persons under the influence of mercury, which might, perhaps, also show why certain remedies are rendered more efficient by combination with that metal. "One of the active effects of mercury," says Sir Gilbert, "is *to alter the natural sensibility of the Lacteals,* so that, under its influence, they absorb indiscriminately that which is excrementitious and nutritive; hence the smell of the breath, since the fœtid particles are carried into the circulation, and thrown off in the *Halitus* of the lungs, or by the salivary glands, in consequence of the mouth of the lacteals losing that selecting tact, by which in their sound state they reject whatever is offered to them, except the chyle. Now, if mercury can act as the "*Soporata Offa*" to the lacteals, it is evident that its combination with active matter may, on some occasions, facilitate the absorption of the latter.

Potass in anthelmintic purges. Lime water has a similar tendency, and may become a useful ingredient in formulæ intended to act upon a slimy condition of the alimentary passages. The purgative action of *Aloes* would appear to have some relation to the presence of bile in the intestines, for it has been remarked by Wedekind and others, that this medicine will not purge, if administered even in large doses, when the stools have been clay-coloured; this fact will suggest the propriety of combining it, in such cases, with *Calomel*. I have myself observed that a grain of the extract of *Colchicum* quickens the operation of this resinous extract.

408. Sir John Pringle speaks of the advantages which may be obtained by combining an alkali with a bitter infusion, by which he says the effects of the former will be greatly increased. Bitters, beyond doubt, from their invigorating influence upon the *primæ viæ*, will expedite, and perhaps increase, the effects of remedies whose operation is connected with changes *in transitu*, or absorption, as in the exhibition of certain diuretics; they also frequently render the stomach and bowels more susceptible of bodies that act by impression, as certain purgatives and emetics; the latter, as is well known, are greatly promoted by the ingestion of bitter infusions. *Sulphate of Quina* has been supposed to have the effect of accelerating the action of mercurials upon the system, as well as to increase the activity of aloetic purges. We may discover the operation of the same principle in some of the more active compounds of nature; many herbs appear to be indebted to a bitter principle for their activity; *Elaterium*,*

* The following are the results of my experiments upon a specimen of Elaterium from Apothecaries' Hall, procured according to the directions of Dr. Clutterbuck.

Water	0·4
Extractive	2·6
Fecula	2·8
Gluten	0·5
Woody matter	2·5
Elatin—Bitter principle	1·2
	10 grains.

as I have ascertained by a careful set of experiments, contains a purgative element, to which I gave the name of *Elatin*, and a distinct bitter principle, which, in itself, is quite inert, and yet its presence in the compound renders the alimentary canal more susceptible of the impression of the active element, and accordingly increases its power. The history of Senna will afford some interesting facts in further elucidation of this subject; the leaves of this plant, like *Elaterium*, appear to contain an active principle in combination with a bitter; which latter principle, although destitute of purgative properties, considerably augments those of the former, for if this be removed, as happens when senna is transplanted into the south of France, the purgative principle is weakened, but may be again restored by the artificial addition of some bitter extractive. The fruit or pods of senna* contain only the purgative principle, and are therefore comparatively feeble, unless the defect be compensated by art. Dr. Cullen has observed that a much smaller quantity of the leaves is required for a dose, if they be infused in company with some bitter plant. The *Mistura Gentianæ composita*, recently introduced into our pharmacopœia, furnishes an excellent combination of this kind. I have also found the watery infusion of *Rhubarb*, which is not active without some assistance, rendered much more aperient by the addition of *Calumba*.

409. The experiments of Seguin have established the fact that the active principle of astringents is *Tannic Acid*, but its efficacy is evidently augmented by the presence of an acid; that peculiar sensation which we so usually experience in the mouth and fauces from unripe fruits, especially those of the plum species, and are designated by the term *acerbness*, is the result of a combination of the astringent principle with some vegetable acid.

410. The relative sweetness of sugar, when in different

* The Arabian and Greek physicians scarcely noticed the leaves, but always employed the pods of senna; a fact which will explain the operation of this plant as observed by them.

degrees of purity, depends upon the operation of the same law of combination; *pure sugar*, as Dr. Mac Culloch has very truly observed, however paradoxical it may appear, *is not so sweet as that which is impure;* the sweetness of *molasses*, compared with that of refined sugar, is too well known to require more than to be mentioned; the vegetable matter* in this case increases the effect of the saccharine principle with which it is combined. For the same reason, grapes differing very materially in their proportion of saccharine matter, may seem to *the taste equally sweet;* and such in fact is the case on comparing the luscious grapes of Spain with the *Chasselas* of Paris; and yet the vinous product is entirely different, the results of the one being a sweet and luscious wine, while that of the other is hard and dry, because, in truth, these grapes contain very different proportions of sugar; and however powerfully the vegetable matter may modify the effects of this principle upon the palate and organs of taste, it cannot alter the quantity of alcohol resulting from its fermentation.† Crystallised sugar also appears less sweet to the taste than loaf sugar, but this may depend upon the different state of aggregation, and consequently the different degrees of solubility, possessed by the sugar in these two forms.

411. From the phenomena of *taste* we may extend our analogies to those of *odour*. A memoir, presented to the Philomatic Society of Paris by M. Robiquet, on the subject of *Aroma*, affords some very interesting analogies in proof of this law of combination. From the experiments of this laborious chemist, it would appear that odours are not, as Fourcroy supposed, the effect of the simple solution of certain bodies in air, but that for their developement some third body, not possessing in itself any of the specific odour, is absolutely necessary as an intermede, its nature in every case varying with that of the odorous base in question. In the same way that the *mordant* requires to be varied by the dyer, according to the

* Herbaceous matter of Dr. Higgins?

† Mac Culloch on wine.

nature of the colouring matter which it his intention to fix on the cloth; thus, *Ambergris* has in itself very little odour, but the addition of a minute quantity of musk developes a very decided one; and the same thing happens in a less degree with lavender, and accordingly the perfumers are in the practice of adding a small quantity of that substance to the distilled water of the plant. In other cases, ammonia lends, as it were, its volatility to bodies, the odour of which, without such an adjective, would be scarcely sensible; this is exemplified by the practice of perfumers exposing their musk and other substances to the atmosphere of privies, when they have lost their power. (*Paul Amman Manduct ad Mat. Med.*) This fact will doubtless explain the effect already noticed, on the authority of Gieger, (*p.* 115,) that the odour of musk becomes developed by putrefaction, during which ammonia is disengaged. So again, in order to give pungency to snuff, it is made to suffer the commencement of fermentation, and it is a curious fact that the odour of the best snuff may be destroyed by mixing it with some *Tartaric Acid.* Iron has little or no odour, but when volatilised with hydrogen its odour is very powerful. The smell of copper and brass must depend upon some analogous cause not at present understood.

412. In some cases the addition of certain bodies will induce the absorbents to admit, and carry into the circulation, remedies which in a more simple state they would reject as excrementitious; this position is supported by the fact that no form of mercury is so readily taken up by absorption, as that in combination with fatty matter, or with some stimulant ingredient, as in the *Linimentum Hydrargyri compositum*, by which the lymphatics are acted upon by the camphor and ammonia. It is a question, also, whether the preparations of iron are not more readily carried into the blood, when introduced into the stomach in the form of *tanno-gallates.* By a parity of reasoning Mr. Carmichael was led to prefer the *Phosphate of Iron* to any other preparations of that metal in cancer, from a belief

that when combined with an animal acid, it would enter the system more readily, and unite more intimately with the animal fluids. This, however, is to be received as a vague speculation.

413. The object of the foregoing observations is to support the proposition, that as *in certain vegetable productions there exist elements which, although in themselves inert, may confer additional activity upon the principal ingredient*, so in artificial combinations, the basis of a medicinal formula may receive an increased efficacy from the co-existence of accessary substances. If we admit the truth of this proposition, it will necessarily follow that there exist two distinct orders of medicinal elements, the one comprehending those that possess an inherent and independent activity, the other those that are in themselves inert, but which are capable of imparting impulse and increased energy to the former when in combination with them. To distinguish these orders, we may designate the former SUBSTANTIVE, the latter ADJECTIVE constituents. To illustrate this by a few examples—in *Sulphate of Quina*, the *Quina* is SUBSTANTIVE, the *Sulphuric Acid* ADJECTIVE. In Cantharides, the *Cantharidin* is rendered soluble and active by the adjective principle, termed yellow matter. *Calumbia*, in an isolated form, is neither soluble in alcohol nor water, yet both these menstrua extract it from the root, by means of the *adjective* ingredients contained in it.

414. The solutions of saline cathartics appear to acquire an accession of power by impregnation with *Carbonic Acid Gas*, depending probably upon the intestines thus receiving a degree of distension necessary for the full operation of the salt; certain it is that the operation of emetics, as well as that of glysters, is materially increased by the stimulus of distention.

415. In enumerating the methods to be adopted for increasing the energy of a remedy, by rendering the system more susceptible of its action, it is necessary to state that, under

certain circumstances, venesection deserves a distinguished place amongst the *Adjuvantia*. The fact is strikingly illustrated in the exhibition of *Mercurial Alteratives;* whether the *Vis conservatrix* which nature, in a state of health and vigour, opposes to the admission of foreign bodies into the circulation be overcome by blood-letting, is a question which I shall leave undecided; but this much I can state from ample experience, that the system which in a sthenic condition* has resisted the action of mercury, has yielded to its influence the moment the stomach became deranged, the circulation languid, or the general tone of the system subdued or relaxed. I have frequently seen this during my hospital practice; if a patient, for instance, who has been using mercurial friction, or taking the preparations of that metal without effect, be transferred into a close and unhealthy ward, his appetite soon fails, the tongue becomes furred, and the system yields to the influence of mercury. Nauseating doses of antimony frequently repeated,†

* Astruc, and other practitioners of the same school, always premised a mercurial course with venesection. It is probable that many of the anomalies observed in the modern use of this remedy may have arisen from an inattention to the diet of those who were submitted to its influence. Mercury is in itself a most powerful stimulant, and ought therefore to be accompanied with a low diet; besides which, the experiments of Majendie have shown how greatly a depleted state of the system will expedite the operation of the remedy.

† Dr. Eberle, of Philadelphia, in quoting the above passage, remarks that he has long been acquainted with the *fact*, although he is disposed to account for it upon different grounds; he considers that nauseants encourage mercurial ptyalism, by favouring an afflux to the salivary glands. The learned author must allow me to congratulate him upon this discovery. as he need not entertain any apprehension in future as to his power of inducing salivation. He has only to condemn the refractory to meagre fare, and then to tantalise them, as poor Sancho was treated in his government, with the sight, or rather smell, of a savoury dish, and he will be sure of securing his object; but to be serious, if Dr. Eberle's views be correct, how will he explain the *modus operandi* of fear, as related in the text? for the tendency of fear is to *diminish* the secretion. The Hindoo ordeal by rice is founded upon this fact. Those who were able to return the rice given them to chew in a pulpy form were acquitted, while those who turned it out of their mouths dry were pronounced guilty.

or the accidental supervention of any disease of debility, have been frequently attended with the same phenomena. My hospital practice has afforded me an opportunity of appreciating the debilitating effects of despondency in a case of this description; a patient had been taking mercurial medicines, and using frictions, for a considerable period, without any apparent effect, when he was abruptly told he would fall a victim to his disease; the unhappy man experienced an unusual shock, and in a few hours became violently salivated. It was formerly observed by Citois, that the inhabitants of the province of Poitou, who had suffered anxiety on account of any misfortunes, were particularly susceptible of the epidemic.

416. Venesection also increases the effects of cathartic medicines. I have often noticed this fact, in contending with diseases of a plethoric diathesis; whenever the bleeding has preceded the purgative, the effects of the latter have been uniformly more speedy and considerable; in obstinate constipation, mild remedies have been known to act more powerfully, when preceded by blood-letting, than potent ones when exhibited antecedent to it. Venesection has certainly an extraordinary power in awakening the susceptibility of the *primæ viæ* to remedial impressions; in some diseases, as in *Cynanche Trachealis*, or croup, so great is the insensibility of the stomach, that emetics will frequently fail; and Dr. Hamilton states that he has given as much as a hundred grains of *Calomel* in the twenty-four hours without any effect. In such cases, venesection will afford extraordinary assistance. Dr. Fothergill also remarks that emetics are more efficient after bleeding. (*Dissert. Med. Inaug.*) The effects of bark, steel, and other tonics, are in some instances influenced in the same manner; whether it may be prudent or judicious to have recourse to such a practice, must be determined in each particular case by the practitioner, and is a question not involved in the present inquiry. Limited must be the experience of the physician who has not witnessed the utility of venesection

in producing a state of system favourable to the operation of various other remedies. In acute diseases, how frequently will an opiate succeed in allaying irritation, after copious bleeding, which would not produce any beneficial influence previous to that operation? This is strikingly exemplified in the treatment of pneumonia, the narcotic quieting the irritability of the circulation, and acting like a charm upon the patient.

417. Purgatives also awaken the susceptibility of the body to mercurial impressions, provided, however, that they be not simultaneously given with the alterative; (134:) and it is remarked by Dr. Chapman that this practice affords a resource which rarely disappoints the practitioner. The advantages also of a course of steel medicines are undoubtedly increased by the previous exhibition of purgatives. The febrifugous and antiseptic properties of diluted *Hydrochloric Acid* are enhanced by a similar practice. I beg to refer the practitioner to some cases published by me in the *Medical and Physical Journal* for December, 1809, in further illustration of these views. Experience also enables me to state that *Diuretics* are assisted by similar means, having many instances in my case-book of the failure of these agents *before*, and their successful operation *after*, the exhibition of a cathartic. Dr. Darwin observes that "*Absorptions are always increased by inanition*," and in support of this proposition refers to the frequent advantage derived from evacuations in the cure of ulcers. Dr. Chapman arrives at the same conclusion; he states that the blood-vessels and absorbents are to a certain extent "*Antagonists*." This opinion is confirmed by the experiments of Majendie. (108 and *note*.) Instructed by this obvious fact, continues Dr. Chapman, we ought, in the exhibition of diuretics, to regulate the state of the system by interposing purgatives, or even venesection, as the state of the circulation may indicate.

418. Emetics also, in certain conditions of the system, would appear to render the stomach more sensible to the im-

pression of other remedies; Dr. Eberle, of Philadelphia, has remarked such an effect with respect to the administration of the bark.

419. CHANGE OF DIET AND HABITS may be also classed amongst the ADJUVANTIA, as so strikingly shown by the convalescence of those who, in their reliance upon the curative effects of the many mineral springs abroad, submit to the regular and early hours of the place in which they reside; this, however, is a subject far too extensive and important to be investigated in this work. I shall merely observe, that the young practitioner is not to exercise his *Caduceus* as Sancho's physician did his wand. I have seen a raw disciple of Esculapius so vex his patient, that his food became more nauseous to him than his medicine; and I verily believe his physician was more irksome than his disease. It is well observed by Dr. Percival, that the prejudices of the sick should never be contemned with wantonness, nor opposed with harshness; for, silenced by authority, they will operate secretly and forcibly on the mind, creating fear, anxiety, and watchfulness. If feelings of aversion are excited by the repast, the stomach will never act with healthy energy on the food; and in cases of extreme disgust, it is either returned, or it passes through the alimentary canal almost unchanged; on the other hand, the gratification which attends a favourite meal is in itself a specific stimulus to the organs of digestion, especially in weak and debilitated habits. Dr. Merriman communicated to me a case which will afford a striking illustration of this powerful influence. A lady of rank, labouring under menorrhagia, suffered with that irritable and unrelenting state of stomach which so commonly attends the disease, and to such a degree, that every kind of aliment and medicine was alike rejected; after the total failure of the usual expedients to appease the stomach and procure relief, she applied to Miss Prescott, and was *magnetised*, when she immediately, to the astonishment of all her friends, ate a beef-steak, and continued to repeat the meal every day for six weeks, without the least

inconvenience! but the disease itself, notwithstanding this treacherous amnesty of the stomach, continued with unabated violence, and shortly afterwards terminated her life.

II.

TO CORRECT THE OPERATION OF THE BASIS, BY OBVIATING ANY UNPLEASANT EFFECTS IT MIGHT BE LIKELY TO OCCASION, AND WHICH WOULD PERVERT ITS INTENDED ACTION, AND DEFEAT THE OBJECTS OF ITS EXHIBITION.

A. *By* MECHANICALLY *separating, or* CHEMICALLY *neutralizing, the offending ingredient.*

420. The scientific physician, from his knowledge of the chemical composition of a medicinal substance, and of the principles upon which its different qualities depend, is frequently enabled to remove, or render harmless, the elements which impart to it a deleterious operation. It is thus that many vegetable substances of a very acrid nature become mild on being boiled, or submitted to some chemical manipulation; and many of them might even, in times of scarcity and want, be converted into wholesome and nutritious articles of diet. Sir John Franklin and his associates, under the severe privations to which they were exposed, gathered the *Liverwort* (*Cetraria Islandica*) as an article of food, but its bitterness rendered it scarcely eatable. The experiments of Westring have shown that the bitterness of this *Lichen* may be entirely removed by maceration in a cold and weak alkaline ley, and a tasteless but nutritious jelly be thus obtained. In the same manner the horse-chesnut (*Æsculus Hippocastanum*) may be deprived of its bitterness, leaving a residuum which will afford a kind of bread; and, according to Parmentier, (*Récherches sur les végétaux nourissans,*) excellent starch may be procured from it. Dr. Darwin observes, that if the roots of *White*

Briony be rasped into cold water, and agitated with it, its acrid juice, together with the mucilage, will be dissolved or swim in the water, while a starch perfectly wholesome and nutritious will subside, and may be advantageously used as food. By a similar species of address, the French prepare from the acrid *Arum* the harmless but highly-prized cosmetic, called "*Cyprus Powder;*" and *Cassava* and *Tapioca*, those well-known forms of starch, are obtained from the juice of the *Jatropa Manihot*, with which the natives of South America poison their arrows. The husk, or cuticle, of barley contains an acrid resin, for which reason it is removed,* and the seed being afterwards rounded and polished in a mill, is formed into what is termed "*Pearl Barley.*" By boiling the onion we dissipate the acrid oil, and render the bulb not only a mild esculent, but adapt it as an excellent poultice to suppurating tumors. Milk, in consequence of its caseous or albuminous matter, is liable to be too heavy and indigestible, and hence, by means of an acid, we remove the offensive part, and obtain a light and refreshing beverage. Tamarind† whey, lemon whey, cream of tartar whey, (Form. 133,) alum whey, (Form. 58,) &c., are produced by boiling the respective acidulous substances in milk, and removing the coagulum thus formed.

421. Aloes have been supposed to contain acrid matter, by the removal of which the substance is rendered milder in its operation; hence the introduction of the "*Extractum Aloes purificatum*" into our pharmacopœia. Some doubts, however, exist upon this subject.

422. Numerous attempts have been made to obviate the subsequent effects of opium, such as nausea, headache, and constipation, either by the abstraction of certain principles, upon the presence of which they have been supposed to de-

* Whence the decoctions of barley have been termed *Ptisans*, from *πτίσσω, decortico.*

† This is made by boiling an ounce of tamarind pulp in a pint of milk, and straining the product.

pend, or by the addition of various substances with a view to counteract them. Under the present division of the subject, it is only necessary to consider the former; the latter will fall under our notice in the succeeding section. An opinion has very generally prevailed that the consequent ill effects of this substance are, in some measure, independent of its specific narcotic power; and among the earlier writers we find various formulæ* proposed for removing the resinous, or some other ingredients, from which the evil might be supposed to arise, but, until the splendid discoveries of Derosne, Serturner, Seguin, and Robiquet, chemistry had not furnished any data for the investigation. The labours of these distinguished men have demonstrated the existence of no less than seven crystallizable principles, three of which, viz. *Morphia*, *Codeia*, and *Paramorphia*, are alkalies; three, viz. *Narcotin*, *Narcein*, and *Meconin*, neutral bodies: and *Meconic Acid*, existing in combination with one or more of the above organic alkalies, so as to form soluble salts; in addition to which there are numerous unimportant ingredients, as *Gum*, *Resin*, *Oil*, *Caoutchouc Extractive*, and several salts of inorganic bases, with which the activity of the drug does not appear to have any material connexion. By an accession of such important knowledge, it might have been expected that we should have readily solved the problem in question, but the subject is still involved in doubt. Thus much, however, we know, that Morphia is the primary narcotic principle, and that Codeia contributes in some way or other to the activity of the substance, although doubts have arisen as to the nature and amount of its influence, for Kunkel, Gregory, Barbier, and Majendie, who have severally examined its physiological effects, differ in opinion; thus, Kunkel regards it as an irritant, exciting the circulation, and producing convulsions, but never inducing stupor nor paralysis; while Majendie maintains that it causes sleep, and in large doses stupor; Gregory considers its immediate effects as analogous to those of intoxi-

* A few of which are mentioned at page 86.

cation, followed in a few hours by depression, nausea, and sometimes by vomiting. With regard to PARAMORPHIA, the same uncertainty exists; Majendie however says, that a single grain injected into the jugular vein, or placed in the pleura, will act like *Strychnia*, and cause tetanus and death in a few minutes. Amidst these conflicting opinions, one fact is at least evident, that *Codeia*, as well as *Paramorphia*, are active elements, and that the powers of *Morphia* must be modified by its union with them. NARCOTIN has been regarded by Majendie as the stimulating principle of opium, that to which all the consequent effects were to be attributed; but doubts have arisen on this point also, in consequence of large doses of that substance having been given without any obvious effect; this conclusion, however, is far from satisfactory; it by no means follows that, because a principle is inactive in its isolated form, it does not exert a power when in a state of combination. My belief is, that all the three alkaloids impart to opium properties not possessed by *Morphia*, and that they are of a stimulating character; let us only compare the effects of morphia with those of opium, will not experience pronounce the existence of stimulating properties in the latter, which are not displayed by the former? and is it not equally obvious that such properties, however unpleasant under some circumstances, may give to the opium, in other cases, advantages not to be obtained by the morphia? In cases, for example, in which our object is to obtain a sustaining and diffusible influence, to excite the arterial system in its remote ramifications, and thus to promote genial warmth, and to reanimate the failing powers, opium is to be preferred to morphia, as in mortification, especially in that form of it termed "*Gangrena Senilis.*" On the other hand, where we desire to mitigate pain, and calm the general irritability of the system, a salt of *Morphia* may better answer such indications, and will certainly be less likely to occasion *after* effects which it has been so desirable to prevent. I will not venture to say that such *after* effects are to be solely attributed to

Narcotin, but I greatly suspect that they are not entirely independent of it. I am satisfied, from experience, that a watery infusion of opium is less obnoxious to them, and Pelletier has shown that the greater part of the *Narcotin* is insoluble in water; (*See Form.* 23;) at the same time it is possible that the resinous matter may be the objectionable principle, which would be equally removed by the action of water.*

B. *By adding some substance capable of* GUARDING THE STOMACH OR SYSTEM *against its deleterious effects.*

423. The virtues of our most important remedies have been frequently lost, or much invalidated, from a neglect of the circumstances comprehended in this section. It may be almost admitted as an axiom, that whenever an *Alterative* acts with violence upon the primæ viæ, its energies are uselessly expended, and the object of its exhibition defeated. In

* LIQUOR OPII SEDATIVUS. Under this name Mr. Battley, a manufacturing druggist of Fore-street, introduced a preparation which has been extensively employed. The remarks which I felt it necessary to offer upon this preparation in the preceding editions of my work, were productive of much unnecessary INK-SHED. I have no desire to renew the grievance. I shall therefore merely observe that, according to my experience, and I have tried it extensively, I never could discover any advantage which might not be obtained with far greater certainty and uniformity by a salt of morphia. Its preparation is kept secret, but my impression is that it is, virtually, little more than a watery solution of opium, although, for the purpose of mystification and concealment, the process may be unnecessarily complicated. Its author was greatly incensed by my having included it under the history of patent medicines, or NOSTRUMS; now, every medicine that is prepared by a secret process, and sold for private advantage, is properly designated as a *Nostrum*, if there be any meaning in the word. Mr. Battley, however, may have been conscientiously critical, and feeling that the receipt had been derived from Wedelius, Le Mort, or some other writer of the olden time, was induced to exclaim with the Roman poet:

"Quæ non fecimus ipsi, vix ea NOSTRA voco."

like manner, *Diaphoretics*, *Diuretics*, and many other remedies will suffer a diminution in their effects, whenever they stimulate the stomach or bowels to excess; and this is more especially the case when the efficacy of the medicine depends upon its absorbtion; thus *Squill* will lose its diuretic, *Antimony* and *Ipecacuan* their diaphoretic, and *Guaiacum* and *Terebinthine* medicines their antiarthritic effects, should they purge or vomit the patient. The action of such bodies may therefore require correction. In order to correct the tendency of squill to pass off by the bowels, and at the same time to direct its action to the kidneys, Dr. Mead combined it with some alkalies; Dr. Cullen preferred opium as a *Corrigent*.

424. *Acetate of Lead*, when administered in Hæmoptysis, or uterine hemorrhage, should be guarded by the addition of some narcotic, as in the *Pil. Plumb. Opiat.* of the Edinburgh Pharmacop., or in *Form.* 62. Opium may also frequently accompany with advantage the various other metallic preparations, as those of *Arsenic*, *Copper*, &c.

425. Dr. Sutton, of Greenwich, has written a paper to show that where we wish to limit the operation of an emetic, and to prevent its action on the bowels, we should add five or six drops of laudanum to the draught, which in his experience has answered the purpose. In some cases we may desire to restrain the action of an aperient pill, given at night, until the following morning; to effect this object, the addition of a small portion of *Compound Powder of Ipecacuan* will be useful. The tendency which mercurial preparations possess of affecting the bowels will also be best corrected by opium. The griping and nauseating effects of some remedies receive correction from the addition of aromatic stimulants, or essential oils, (*Form.* 92, 96, 98, 100, &c.,) or a portion of a corresponding tincture. The griping from senna may be generally obviated either by a warm tincture, or a saline aperient, or according to Dr. Christison, by sugar. Sir H. Halford informs me that in his practice he has uniformly found the addition of *Extract of Hyoscyamus* to render the operation of

the *Compound Extract of Colocynth* much milder, and no less efficacious. Of the value of such a combination I can myself bear ample testimony; and Dr. Barlow, in his excellent practical essay on Gastrodynia, (*Encyclopæd. of Medicine*,) recommends a combination of two parts of the *Extract of Colocynth* with one of that of *Henbane*, in order to keep the bowels free during the intervals of more active treatment. The editors of the Edinburgh Pharmacopœia would appear to have entertained the same favourable opinion of this combination, as they have introduced a form of it, under the title of *Pilulæ Colocynthidis et Hyoscyami*. There is, however, an advantage in considering it as extemporaneous, since we can thus vary the proportions according to circumstances.

426. The addition of *Sulphuric Acid* to a solution of the *Sulphate of Magnesia*, renders that purgative salt less liable to gripe; at the same time it covers its bitter taste, makes it sit easier on the stomach, and prevents its disturbing the digestion; but to secure such effects it should be added freely.

427. *Alum* is corrected in its tendency to disturb the bowels by the addition of nutmeg, (*Form.* 58, 60,) or by some other aromatic.

428. Several substances are rendered less acrimonious by certain demulcents, as mucilage, almond emulsion, barley-water, milk, &c. The *Mistura Scammonii** of the Edinburgh College affords a good example of this kind. I have frequently used it with satisfaction.

429. In certain cases we may desire to defend the stomach from the immediate *local* action of a remedy which is to act upon remote parts by absorption; in the administration of alkalies, as *Antilithics*, we accomplish this by exhibiting them in combination with a vegetable acid, in the form of a saline draught. *Bichloride of Mercury* may, upon the same prin-

* Take of the resin of scammony, seven grains, unskimmed milk, three fluid ounces; triturate the resin with a little of the milk, and gradually with the rest of it, till a uniform emulsion is produced.

ciple, be guarded by the decoction of *Guaiacum*, or *Sarsaparilla*, or by the plentiful exhibition of mucilaginous drinks and broths. The local action of *Iodine* upon the stomach may also be obviated by amylaceous matter, forming an *Iodide of Starch*, in which its constitutional influence will remain unimpaired.

430. Formulæ have been proposed with a view of enabling the practitioner to administer the *Nitrate of Silver*, without incurring the danger of giving a permanent blue tinge to the skin of the patient. I have lately seen a prescription in which a solution of the *Nitrate of Silver* was directed to be administered in a weak solution of potass; we should in that case obtain the *Oxide of Silver*;* but it has been stated that a metallic oxide, although insoluble in water, may be taken up by the absorbents, (36,) and we know that the equally insoluble *Chloride* has, by its continued exhibition, been absorbed and deposited in the rete mucosum.† What then is the alternative in such a case? either that the oxide being insoluble in the gastric juice is rejected, and therefore perfectly inert, or that it combines with the juices of the stomach and is absorbed, and therefore liable to occasion the very evil which it is our object to avert. In such a supposed prophylactic combination I would not advise any practitioner to put his trust.

431. In certain diseases of the uterus and vagina, astringent lotions and injections may be indicated, but it may happen, as for instance in the cauliflower excrescence, or in the oozing tumor of the labium, that such applications are too irritating; in such cases the effect may be *corrected* by the addition of mucilage.

* A communication upon this subject has been made by Mr. Lane, (*Medico-Chirurg. Review, July* 1840, *p.* 289,) in which he advocates the superiority and safety of the oxide of silver, and gives several cases in support of his opinion.

† I have seen a patient turned blue by the *Nitrate of Silver*, exhibited in the *Compound Decoction of Aloes*.

432. The enfeebling influence of *Digitalis*, *Tobacco*, and other sedatives, may be counteracted by ammonia and different stimulants; but it will be for the practitioner to judge how far such corrigents are admissible, or are likely to invalidate the efficacy of the remedy.

433. In the foregoing section we have inquired whether it were possible to correct the operation of opium by the *abstraction* of any, and which of its constituents; we have now to consider how far the *addition* of any corrigent may avail in averting its adverse consequences. Experience has certainly shown that its constipating effects are best obviated by the addition of an *Aloetic* preparation. I have also found the conjunction of some bitter, as *Gentian*, to render it less liable to this inconvenience; we must remember that one of the effects of opium is to suspend, for a time, the muscular action of the intestines, and bitters are known to promote it. The addition of *Calomel*, or some mercurial, will also tend to counteract its paralysing influence upon the biliary functions, and gall ducts; I have known many persons who could never take opium without passing, for several successive days, clay-coloured motions; whereas such an effect has been obviated when calomel has been exhibited in union with it. In cases where laudanum is liable to produce nausea, the best adjunct is the *Compound Spirit of Æther*, or some aromatic, as contained in the *Vinum Opii*, the *Tinctura Camphoræ comp.*, or the *Tinctura Opii Ammoniata* of the Edinburgh College. *Camphor* is also supposed to counteract its after effects. Some practitioners place much reliance upon the *Potassio-tartrate* of antimony. Much also has been said in commendation of the correcting powers of a vegetable acid,* especially *Vinegar;* but its principal virtue would appear to consist in

* Dr. Porter, of Bristol, some years since, introduced to our notice a solution of opium in citric acid, which certainly possesses the merit of a powerful anodyne, and, according to my own experience, operates with less disturbance than the ordinary forms of this drug. The following is his formula for its preparation. ℞ Opii ʒiv., Acidi Citrici (cryst.) ʒij,

its solvent power over the *Morphia;* after the opium, however, has passed out of the stomach, it would seem to exert an anti-narcotic influence, as already stated. (275). Opium will occasionally act upon the kidneys, and, in certain affections of the bladder, increase the very distress it was intended to relieve; some practitioners have considered the addition of vinegar as calculated to give to opium this peculiar tendency. The corrigent in such a case would be to unite it with *Antimony* or *Ipecacuan*, with a view to determine its action to the skin.

434. In the exhibition of *Oil of Turpentine* in large doses, for the cure of tapeworm, should it fail to purge, it will be absorbed into the system, and may occasion a mischievous excitement on the cerebral and other organs, especially the kidneys; to obviate such a result, it may be judiciously combined with *Castor Oil.*

435. With a view to prevent the remote effects of a blister upon the urinary organs, it has been proposed to place a piece of thin silver paper, soaked in oil, between the plaster and the skin. The oil not being mixible with the blood, is not readily absorbed, and hence, probably, its protective influence.

436. In some cases the unpleasant or perverse operation of a remedy may be obviated by changing the form of its exhibition, the extent of its dose, or the period of its administration; thus the nauseating tendency of camboge, which is connected with its ready solubility, is prevented by incorporating it with some less soluble body, as in the *Pilulæ cambogiæ compositæ*, or, which may be considered equivalent in principle, by giving smaller doses at shorter intervals, as recommended by Dr. Cullen. With regard to opium, there cannot be a doubt that its distressing *after* effects, such as headache, nausea, &c.,

semel in mortario lapideo contunde, dein aquæ destillatæ bullientis Oj affunde, et intime misceantur; macera per horas viginti quatuor, et per chartam bibulosam cola. The Brunswick Pharmacopœia contains a somewhat similar preparation.

have frequently arisen from its having been taken too soon after a full or indigestible meal, or after too much wine, or during a loaded state of the bowels.

437. Before quitting the subject, it may deserve notice, that there sometimes exists a *chemical* condition of the stomach which may impart to a mild medicine the characters of harshness and violence. The vinous infusion of *Colchicum* would thus appear to act more powerfully in an acid condition of the stomach; small doses of *Magnesia* may therefore very properly precede or accompany its exhibition; and as this remedy, moreover, is liable to debilitate the stomach, it may be expedient, in certain cases, to conjoin it with aromatics. The irritation occasionally produced by Mercury upon the mucous membrane may depend upon the existence of a free acid, or perhaps, as Dr. Venables supposes, of chlorine in the stomach. In such cases its union with chalk, as in the *Hydrarg. cum Creta*, will be necessary,

III.

TO OBTAIN THE JOINT OPERATION OF TWO OR MORE MEDICINES.

A. *By combining those substances which are calculated to produce the* SAME ULTIMATE EFFECTS, *although by totally different modes of operation.*

438. It has been already stated (114) that we may frequently combine substances with considerable advantage, even should their modes of operation be dissimilar, provided always that they be not physiologically incompatible with each other. This subject may at once be rendered intelligible by a reference to the operation of purgatives. A series of medicinal substances may be produced, each of which has the property of exciting catharsis, but by a very different and distinct mode of action; one, for instance, will stimulate the muscular fibres of the alimentary canal; a second will act

upon the exhalant vessels and mucous glands; and a third will expend its influence in stimulating the neighbouring organs, so as to produce an increased flow of their secretions into the bowels; but, since such operations are perfectly compatible with each other, they may be simultaneously established, not only without loss of efficacy, but with an obvious accession of power. Suppose, for example, we administer a substance which, from its specific nature, exclusively acts upon the muscular tissue of the canal, the peristaltic movements will be accelerated, and the contents of the bowels urged forward and evacuated; but the operation will be comparatively slow and reluctant, and *griping* may be the consequence; now it is evident that, if to a medicine of this kind we add one which will produce an increased flow of fluids, the effect will be quickened, as well as corrected; the *Infusion of Senna* will derive this combined advantage by the addition of a saline aperient. (*Form.* 94). So, again, in the use of sedatives, *Digitalis* and *Hydrocyanic Acid* cannot be regarded as similar, since the one acts upon the circulation, the other upon the nervous system; but their operations not being incompatible with each other, they may often be combined with advantage in the same formula. (*Form.* 77, 78.) The power of an effervescing saline draught, in checking sickness, is well known; and the anti-emetic influence of *Calumba* is equally acknowledged; the modes of operation of these remedies may very probably be dissimilar, but there is no reason for supposing them incompatible, and they may therefore be combined with propriety. In like manner, many of the articles included in the class of diuretics, however much they may differ, if they be not adverse, may be conjoined; for example, *Digitalis* and *Potass* cannot be said to be similar, nor are they adverse; for, while the alkali, through the medium of the circulation, travels to the kidneys, and stimulates their secreting functions, the *Foxglove* may arouse the energy of the absorbents. In the administration of diaphoretics, also, it will be readily seen that by combining those which relax the cutaneous emunc-

tories, with such as act by increasing the momentum of the circulation, we shall obtain a greater and more certain effect; such I apprehend to be the theory of the diaphoretic operation of *Dover's Powder*. *Iron* and *Quassia* are both tonics, and although they act differently, they may nevertheless be combined with advantage. (*Form.* 45.)

B. *By combining medicines which have entirely different powers, and which are required to obviate different symptoms, or to answer different indications.*

439. Arrangements constructed upon this principle constitute most valuable remedies; they are in general *extemporaneous*, since their very value depends upon their being varied and modified, according to the symptoms and circumstances of each particular case; the pharmacopœia therefore directs but few of such combinations, although it has given its sanction to the principle in the introduction of the *Mistura Cascarillæ composita*, and the *Mistura Gentianæ composita*. The following general view of the subject will explain its nature and importance.

440. Exhilarants with Tonics. In the cure of various dyspeptic, and other affections, we frequently require a remedy for the purpose of rousing the powers of the system more promptly and energetically than can be effected by a bitter tonic, or a preparation of iron, whose operations are necessarily slow and almost imperceptible, (78,) while a case may at the same time stand in need of that permanent increase of tone which the exhilarant alone is incapable of affording. Such an indication, therefore, must be fulfilled by extemporaneous combination. *Ammonia* is an excellent adjunct to the *Compound Steel Mixture*, (*Form.* 49,) or to the *Trisnitrate of Bismuth*. (*Form* 53.) I have also frequently found the advantage of adding a few drops of the *Oil of Cajuput* to similar medicines. (*Form.* 54.) It has been already stated (368) that

nature has presented us with compounds, the value of which depends upon their possessing a union of such qualities.

441. Antispasmodics with Tonics, or Narcotics. Under the history of antispasmodics it has been observed, that there are certain bodies which would appear to exert a specific control over inordinate muscular action, from whatever cause it may have arisen; (75;) in the administration, however, of such remedies, the intelligent practitioner will not overlook the peculiar condition of the system in its relations to the disease; when debility is present, the antispasmodic will be usefully combined with a tonic, as *Valerian* with *Carbonate of Iron*, or with *Bark;* (*Form.* 36;) and in certain morbid states of the nervous system with a narcotic. (*Form.* 30.) In short, there is no class of diseases, the treatment of which requires greater discrimination and judgment than that of spasm, and no one, probably, which is less under the guidance of therapeutical generalities. Dr. Whiting has judiciously observed that, in many cases of painful disease, anodynes, by deadening the feelings of the patient, may prove auxiliaries to those remedies which are given with a more direct view to the removal of the disease itself; for, as the sensation of pain frequently acts upon the system as an irritant, so may the suspension of that sensation, by means of an anodyne, allow such diseases to come more completely under the operation of the remedies which may be administered to subdue inordinate actions. (*Cyclop. of Med., Art. Anodyne.*)

442. Narcotics with Excitants. Where our object is to secure the exhilarating effects of a narcotic, we may successfully conjoin it with an aromatic stimulant; as exemplified in the *Tinctura Camphoræ comp.*, and the *Confectio Opii* of the London, and the *Tinctura Opii Ammoniata* of the Edinburgh Pharmacopœia. It is upon this principle that the Turks combine opium with various stimulants, the object being that of promoting hilarity; (64;) and in the treatment of various diseases, the practitioner will readily understand the advantages to be derived from such a combination.

443. Narcotics with Mercurial Alteratives. The former may be supposed to act upon the nervous system, the latter upon that of the capillaries. In this way I would explain the beneficial effects which I have so frequently experienced from a combination of four or five grains of the *Extract of Conium*, with a grain of *Calomel*, in chronic rheumatism. It was a popular formula in the Westminster Hospital, when I was physician to that institution, and in private practice, I have ever since employed it with obvious advantage.

444. Tonics with Purgatives. During the exhibition of tonic medicines, it is frequently essential to accompany them with purgation. In intermittent fevers, for instance, when attended with a redundant secretion of bile, or with any visceral obstruction, the *Bark*, or some equivalent preparation of *Quina*, must be given in combination with some aperient, for which purpose Boerhaave recommended the *Muriate of Ammonia*, Mead, *Rhubarb;* while in many cases experience has suggested the propriety of selecting some of the warmer and more stimulating cathartics, especially those of aloes. I shall here take the opportunity of observing that, notwithstanding the opinion so strongly expressed by Sydenham, that "*to add anything to the bark, argues either ignorance or craft*," the most respectable testimony may be adduced in favour of the many advantages that have arisen from the various combinations of this heroic remedy. Sir George Baker has said that "*there is less of reason than of severity*" in the above remark of Sydenham; for it had been found in the intermittent fever which he has described, that, according to circumstances, sometimes the *Virginian Snake-root*, and at other times *Myrrh*, were added to it with the greatest advantage. According to the experience of several practitioners, a drachm of the *rust of iron*, (*Sesquioxide*,) and the same quantity of the powder of black pepper, added to each ounce of bark, have been the means of subduing the most inveterate agues. *Formula* 45 presents a combination, which we learn from Dr. Petrie's letter to Sir George Baker, constitutes a celebrated

Dutch remedy for an ague, and which was tried with success in the hospital at Lincoln, in those obstinate intermittents which prevailed in the year 1781. Hillary speaks of an epidemic intermittent at Barbadoes, in which the bark was of no avail, unless when combined with saline remedies, or some of the tonic bitters. Dr. Barton has stated that bark combined with mercury in small proportions, is one of the best remedies for resolving an enlarged spleen consequent upon an ague.

445. Astringents with Tonics. A combination of certain medicines belonging to these two classes is frequently indicated; in the treatment, for instance, of passive hemorrhage, we have to astringe the bleeding vessels, and at the same time to cure the hemorrhagic diathesis by remedies which are calculated to restore the general tone and vigour of the system; so in the treatment of the chronic and humid cough of old persons, I have frequently witnessed the beneficial union of an astringent, such as *Sulphate of Zinc*, with some tonic or stimulant.

446. I will take this opportunity to remark, that in superseding the preparations of the bark by the salts of *Quina*, we deprive ourselves of any power that may be derived from the astringent principle, (*Tannic Acid*,) and there is reason to believe that its presence in the native combination heightens the tonic virtues of the alkaloid.* Dr. Rolander, of Stockholm, considers the *Tannate of Quina* to be most energetic of all its salts; any objection, founded upon

* It has been remarked by Berzelius, that the most active species of bark are those which contain the largest proportion of tannic acid. He tells us that there exists a law in Sweden, by which every cinchona bark, imported into that country, is tested by the *Infusion of Galls*, which precipitates the alkaloid: by the *Persulphate of Iron, Gelatine*, and *Emetic Tartar*, which respectively throw down the *Tannates* of iron, of gelatine, and of antimony; and he pointedly remarks, it is proved by the experience of more than sixteen years, that *the most efficacious bark is that which precipitates gelatine and emetic tartar most abundantly*; that is to say, the one containing the greatest proportion of *Tannic Acid*. In this case, nature points out the advantage to be derived from the union of a tonic bitter with an astringent.

its comparative insolubility, is obviated by the addition of a small portion of acetic acid.

447. Astringents with Diaphoretics. Dr. Fordyce has observed that combinations of this kind are often indicated in cases of diarrhœa, where it is necessary to astringe the vessels of the intestines, and at the same time to relax those of the skin; such an indication, he says, may be fulfilled by the exhibition of *Tormentil root*, or any other vegetable astringent, with *Ipecacuan.* (*Form.* 57, 72.)

448. Astringents with Antacids, as illustrated by the Pulvis Cretæ compositus, which consists of *Tormentil* and *Chalk*, to which are added *Cinnamon* and *Pepper*. See also *Form.* 67, 68, 160.

449. Astringents with Narcotics. It has been already observed, (91,) that in a diarrhœa depending upon the influx of acrid fluids into the intestines, there are three modes by which the malady may be checked, *viz.* by a *narcotic*, diminishing the irritability of the intestines; by an *astringent*, restraining the serous excretion; and by an *absorbent*, neutralizing the acrid matter. As the modes of action are not incompatible with each other, they may be simultaneously established with advantage; although it is not intended that such a combination should supersede the previous exhibition of a purgative. In those morbid states of the alimentary canal, in which an aphthous condition of the mucous lining is to be apprehended, small doses of the *Sulphate of Copper* with *Opium* will frequently afford much benefit; (*Form.* 74;) or in some cases the *Mist. Ferri. comp.* may be combined with the narcotic. In external applications, as in *Collyria*, the union of *Sulphate*, or *Acetate of Zinc* with laudanum will be useful. See *Form.* 62, 65.

450. Purgatives with Narcotics, and Antispasmodics. The practice suggested by Drs. Stott and Warren, in the treatment of *Colica Pictonum*, affords a striking example of the expediency of combinations of this nature. It is found, in that disease as well as in others attended with spasmodic

stricture of the alimentary canal, that purgatives will not produce an effect, unless the spasm be simultaneously allayed, by a combination with opium. (*Form.* 107, 114.) It is from such a cause that the purgative so popular with tailors and shoemakers, and which consists of *Aloes* and *Sagapenum*, (*Pil. Sagapeni comp.*,) affords such prompt relief in the spasmodic cholic, to which such persons, from the attitude in which they sit, are so frequently exposed. (*Form.* 113.) I have also frequently witnessed the good effects of the union of *Aloes* and *Assafœtida*, in correcting the sluggish bowels of elderly persons. (*Form.* 114.) Dr. Sutton states that a combination of some drastic purgative with a narcotic, as that of *Elaterium* with *Opium*, will frequently relieve a paroxysm of gout; and many years since, it was mentioned in the earlier editions of the present work, that Mr. Carrick Moore proposed an infusion of *White Hellebore* with *Laudanum*, as a compound analogous in its effects to the *Eau Medicinale*, and that it was found to possess the efficacy attributed to it. The *Colchicum*, now regarded as the active element of that nostrum, would appear to combine within itself the joint powers of a cathartic and sedative, and Dr. Barlow thinks it probable that it is to the coexistence of such qualities its peculiar virtues are to be ascribed.

451. Purgatives with Excitants and Tonics. These constitute the daily resources of the practitioner. The addition of some warm stimulant to assist and correct the operation of a purgative, is a practice of universal adoption; there is not a single purgative pill or powder, in our pharmacopœia without it; we find *Myrrh*, *Saffron*, and *Cardamoms*, in the *Compound decoction of Aloes;* and *Ginger* in the *Infusion of Senna.* See also *Form.* 105, 115, &c. In cachectic habits I have found *Form.* 97 of great value in correcting a sluggish state of the bowels. It often occurs in a case requiring the continued exhibition of aperients, that the strength of the patient must be supported under such discipline; in which case the addition of *Steel* as a tonic will be found beneficial; the Cheltenham, and other

well-known waters of a similar nature, offer natural combinations of this character. (*Form.* 91.) *Mistura Gentianæ comp.* of our pharmacopœia has been constructed for a similar purpose. (*Form.* 99.) In the cure of dropsy we have generally two indications to fulfil—to evacuate the water, and to support the general strength ; hence the necessity of combining brisk and stimulating purgatives, such as *Jalap*, &c., with powerful tonics ; and the same medicinal arrangement is not unfrequently indicated in *Amenorrhœa* and other diseases. (*Form.* 118.)

452. Purgatives with Mercurial Alteratives. In habitual costiveness, where there appears to be a deficiency of bile, a combination of *Calomel* with certain *Aloetic* compounds may prove useful ; for while the latter remedy, in the absence of bile, will supply a congenial stimulus to the intestines, the former will tend to restore the biliary secretion by its influence upon the hepatic system. (*Form.* 109.) Under similar circumstances I have found a combination of the *Extract of Colchicum* and *Pil. Hydrarg.* promote healthy discharges of bile. (*Form.* 110.) There is a circumstance, however, connected with this subject, of which it may be necessary to remind the practitioner, that active purgation and absorption are never simultaneous operations ; (134 ;) although the former, after its effects have entirely ceased, may increase the activity of the latter. (117.) If, therefore, our object be to introduce the mercurial into the general system, the force of the purgative must be cautiously adjusted, or its exhibition must precede that of the alterative.

453. Purgatives with Diaphoretics. This combination of effects is often useful, but it is desirable that the latter should not be produced, until the former have subsided. This may generally be accomplished by well-adjusted doses of the *Potassio-tartrate of Antimony*, in union with a warm purgative. The *Pulvis Aloes compositus* offers a good example of this kind.

454. Diuretics with Tonics. As dropsy is generally asso-

ciated with great debility, the practitioner will often do well to combine his diuretic with some tonic; but in forming a judgment upon this point, he must submit himself to the guidance of those precepts which have been laid down under the physiological consideration of diuretics. (126.) The *Ferri Potassio-tartras* is an officinal preparation possessing the united properties of a diuretic and tonic; the former, however, being so weak as to require the union of other diuretics to augment its powers; fortunately it may be combined with either acids or alkalies without decomposition.

455. Diuretics with Excitants. Such combinations will be found expedient in those cases in which the powers of the system require to be excited and upheld by more prompt measures than those afforded by tonics. *Ethereal* and *Ammoniacal* stimulants with *Squill* and other powerful diuretics will, upon such occasions, furnish appropriate assistance. The following formulæ will illustrate these views, viz. *Form.* 127, 129, 130, 131.

456. Diuretics with Alteratives. In the cure of dropsy we have not only to evacuate the accumulated fluid, but to attempt the removal of that diseased condition which may have given origin to it; hence diuretics may be rationally combined with *Mercurials*, (*Form.* 135,) or perhaps, in some cases, with the compounds of *Iodine.* The *Iodide of Iron*, and the *Biniodide of Mercury*, offer themselves as efficient ingredients in such combinations.

457. Diaphoretics with Tonics. How frequently is the practitioner desirous of determining to the skin, and, at the same time, of supporting the powers of the system? In the progress of a continued fever we are often called upon to fulfil such indications. Dr. Bree, in his work on "Disordered Respiration," also observes that, in the exhibition of *Diaphoretics*, the addition of a bitter infusion or tincture is frequently proper; for the stomach should be gently excited, and strengthened, during the use of a diaphoretic draught: on the other hand, *Tonics* not unfrequently require the aid of a

Diaphoretic; for instance, in the cure of *Cynanche Maligna*, the use of the *Bark* is indicated; but if the skin be hot and dry, it should be accompanied with a *Diaphoretic*. The *Infusion of Serpentaria* with *Ammonia* will often in a state of typhoid prostration convert the hot and dry into a moist state of the skin. In that state of acute rheumatism when the powers of life are depressed, the *Acetate of Quina* combined with *Opium* will often be highly serviceable.

458. Expectorants with Tonics. The *Mistura Cascarillæ composita* affords an excellent combination of this kind. The formula was introduced into the pharmacopœia, from the success which has attended its exhibition in several of our large hospitals, in asthmatic and bronchial affections, attended with much debility, but without fever. It combines the virtues of an active tonic with those of a stimulating expectorant, while the latter is much assisted by the opium, which removes the constriction of the pulmonary exhalants.

459. Expectorants with Excitants. In some cases the expectorant requires to be conjoined with a diffusible stimulant, as in certain stages of *Peripneumonia notha*, in which the powers of life are ebbing, and the lungs become inundated with viscid mucus. In such states *Ammonia* is a valuable remedy. (*Form.* 149.) The addition of *Opium*, in very small doses, may not be objectionable, but useful in allaying irritation; but should it check expectoration, it would prove highly mischievous.

460. Antacids with Carminatives, Tonics, Purgatives, and Sedatives. In the cure of *Cardialgia*, we have often to contend with flatus, debility of stomach, constipation, and a morbid sensibility of the primæ viæ; hence the value of the above combinations. (See *Form.* 161, 162, 163.) Dr. Prout recommends the addition of a few grains of the *Nitrate of Potass* to the antacid, which he considers to act as a sedative upon the morbidly irritable stomach. (*Form.* 164.)

461. Antilithics with Narcotics, Diaphoretics, or Tonics. The general principles upon which the treatment of calculous

disorders is to be conducted, have been already considered. It is therefore only necessary to state, that circumstances will occur in each particular case that may require a combination of remedies. The antilithic, whether it be alkaline, as in the *Lithic*, or acid, as in the *Phosphatic* diathesis, may derive additional value from various accessory remedies. To allay nephritic irritation, *Opium*, or *Henbane*, may be added. (*Form.* 168.) To correct a dyspeptic habit, various *Stomachics*. (*Form.* 165.) To correct a cachectic state, *Tonics;* and to encourage a free discharge from the skin, *Diaphoretics* may be combined. In a gouty habit, the practitioner will have to decide whether some preparation of *Colchicum* might not be added with advantage.

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462. In the construction of these composite *Formulæ*, considerable experience and judgment are required. In the foregoing section I have endeavoured to point out, *generally*, the nature of the advantages to be obtained by such combinations; but they are not to be adopted without the nicest discrimination. No written instructions can ever embrace the whole extent of the subject; its leading points, however, may be seized by the student, and made the topics of his own reflections and examination. A work may give him a general idea of the subject, but his practice and experience can alone give him full possession of it.

463. In the arrangement of these combinations, we should rarely attempt to fulfil more than two indications, although cases may occur in which it will be eligible to assail the disease with an engine of triple powers, *e. g.* in *formula* 67, each of the three ingredients, *Chalk*, *Opium*, and *Catechu*, are calculated to answer different indications, or rather to produce the same ultimate results by three different modes of operation. In the *Mist. Cascarillæ comp.* to which an allusion has been just made, there is the tonic power of the *Cascarilla*, the expectorant virtues of the *Squill*, and the antispasmodic influence of the *Opium*.

464. In the investigation of a disease it will sometimes happen that, after the most diligent examination of the symptoms, and after we have succeeded in referring the majority of them to one common and obvious cause, there will still remain one which defies our classification, and which may be compared to what philosophers term a *residual phenomenon;* it will be for the practitioner to consider how far it will be wise to attack such a symptom by distinct means. I would warn him to be cautious how he prescribes for symptoms, instead of grappling with causes; pain, however, if possible, should always be allayed, since it often baffles the efforts which nature is disposed to make for the relief of disease.

465. In constructing these formulæ we must take care not to fall into the error of CONTRA-INDICATION, and combine remedies which possess properties essentially opposed to each other; this is an error of a most serious description, and unfortunately one of too common occurrence in the lower walks of medical practice—"*Crimine ab uno disce omnes.*" Some time since I met with a country practitioner who, upon being asked by a lady whom he attended, the intention of three different draughts which he had sent her, answered, that one would warm, the second cool her, and the third was calculated to moderate the too violent effects of either; such a practitioner should take warning from the fable of the Traveller and Satyr, or like the former he may stand a chance of being discarded for blowing hot and cold with the same breath. It is thus that discredit and contempt fall upon the use of medicines, which ought only to attach to the ignorant pretenders who administer them; instances so glaring as the one I have just related are not of ordinary occurrence, but others, less palpably inconsistent, but not less objectionable, are by no means rare. I have on the table upon which I am writing a prescription, in which *Hydrocyanic Acid* and *Strychnia* are the principal ingredients, thus combining a sedative to a stimulant of the nervous system. I shall have to

recur to the subject under the investigation of *Physiological Incompatibilities.*

466. In concluding this important subject I may remark, that the question will often arise whether it may not be advisable to administer medicines which are intended to answer different indications at separate times, rather than to present them in combination with each other? Dr. Prout has made some valuable remarks upon this point. In cases of mal-assimilation, tonics are indicated with a view to control the diseased actions which produce it, while chemical agents are required to neutralize the effect of such mal-assimilation on the living system. These two classes of remedies are distinct, and are more effective when separately administered, than when associated. So, again, in the exhibition of alterative doses of *Mercury*, it has been proposed to precede the mercurial with an antacid, rather than to administer it simultaneously; there can be no reason why both plans should not be adopted, in an acid condition of the stomach. In treating this question, the observations that would be naturally suggested, regarding the propriety of separately exhibiting purgatives with mercurial alteratives, have been anticipated. (452.)

IV.

TO OBTAIN A NEW AND ACTIVE REMEDY, NOT AFFORDED BY ANY SINGLE SUBSTANCE.

A. *By associating medicines which excite different actions in the stomach and system; in consequence of which,* NEW, *or* MODIFIED, *results are produced.*

467. This constitutes, by far, the most obscure province in the philosophy of medicinal combination, and must so continue, until we become better acquainted with the laws which govern the physiological actions of medicinal bodies. That the most valuable effects are, however, actually thus pro-

duced, we have the testimony of long experience, supported by the acknowledged efficacy of many well-known combinations; thus, for instance, the *Pulvis Ipecacuanhæ compositus* contains as its active ingredients *Ipecacuanha* and *Opium*, and yet, in well-regulated doses, it neither possesses the nauseating tendency of the one, nor the narcotic influence of the other, they would appear to be materially subdued, or so modified as to be converted into a diaphoretic; in like manner, the *Pilula Hydrargyri Chloridi comp.* is not distinguished by those effects which characterise the operation of its ingredients, but by a new *alterative* power which is generated by their combination with each other. Many other esteemed formulæ would fall under the same category, whose medicinal effects are not to be explained upon any other known principle of combination; but so entirely empirical is it, that we ought to view all its bearings with a jealous scrutiny. In the fourth edition of this work it was stated, on the authority of Dr. Chapman, that *Kino*, an astringent, when administered in union with *Calumba*, constituted a pretty certain and powerful purgative; an effect which could never have been predicted from the known nature of the ingredients, but which, if true, might have found a shelter under the present division of the subject. In order, however, that we might arrive at a just conclusion, I requested the assistance of Dr. John Davy, whose character for experimental accuracy, and whose situation as superintendent of the medical division of the General Military Hospital at Chatham, seemed to point him out as a person preeminently calculated for such an inquiry; and the results of his trials, so far from confirming those of Dr. Chapman, unquestionably proved that neither *Kino*, nor *Calumba*, when taken separately, had a constipating effect, but that, *in the form of powder*,* especially the *Calumba*, each had an aperient tendency, without its being in any degree increased by intermixture. The trials from which these inferences were drawn

* An effect to be attributed to the mechanical state of the substances, "*Sunt quæ ruditer pulverata alvum movent.*"—GAUBIUS, sec. 362.

were made on different individuals in tolerable health, and they were repeated more than once; in some cases the substances in question were given separately, and in others mixed, in doses varying from a scruple to a drachm. It cannot, however, be denied that instances do occur in which medicinal bodies, in union with each other, produce effects not readily explained upon any known principle, and hence the necessity of providing a division for their reception.

B. *By combining substances which have the property of acting* CHEMICALLY *upon each other; the result of which is the formation of* NEW COMPOUNDS, *or the decomposition of one or more of the original ingredients, and the developement of their more* ACTIVE *elements.*

A. *The formation of* NEW COMPOUNDS.

468. We need not travel beyond the range of our pharmacopœia to derive the most satisfactory and striking examples, in illustration of this division of the subject; all the metals, with the exception probably of iron, which would seem to be soluble in the gastric juice, are absolutely inert; but mark what these powerless bodies become by their union with other substances—compounds of fearful energy, although of the utmost value in the hands of the skilful practitioner. Look again at the compound familiarly termed a *saline draught*, for whose production we unite an acid and an alkali, the characteristic effects of both of which are mutually destroyed, or *neutralized*, and a compound of new powers is produced. If we compare the properties of æther with those of the chemical compounds, from the elements of which it is produced, we have a still more striking example. In studying the nature of many of these decompositions and recombinations, we cannot but feel surprised at the novel and unexpected qualities of the resulting compounds; for example, *Sulphate of*

Potass is a substance possessing but a weak affinity for water, and exerting but little energy upon the animal economy, whereas its two ingredients are distinguished for the extreme eagerness with which they unite with water, and for the caustic activity which they display in their action upon animal matter; on the other hand, while the acid and caustic properties of the *Oxalic Acid* are neutralized, as to its *local* action, by an alkali, the resulting compound still retains its poisonous qualities; and so with nitric acid and potass, although their effects upon the stomach may be annulled by mutual neutralization, the compound arising from their union acquires the new power of acting as a sedative upon the nervous system, or of stimulating the kidneys as a diuretic, according to the circumstances under which it may be administered. *Tartrate of Potass* and *Tartrate of Ammonia* have each a bitter taste, but when brought to act chemically upon each other, the resulting double salt has a cooling taste, without the slightest bitterness. A still more striking example of the reversal of qualities occurs in the mixture of a solution of *Nitrate of Silver* with that of *Hyposulphite of Soda*, both of which, although intensely bitter, produce a compound of extreme sweetness. In the formation of *Iodide of Iron*, we have two insoluble bodies, producing, by combination, a compound of great solubility. In like manner, the *Sulphate of Iron* and *Carbonate of Soda* decompose each other, and in the resulting *proto-carbonate* we obtain an active remedy not afforded by either ingredient. I also beg to refer the practitioner to *Formula* 89, which presents an instance of a purgative draught produced by combination, in which the original properties of every element are entirely changed. In *Formula* 90, the chemical actions are more complicated, but not less instructive; the original ingredients, it will be observed, are the *Sesquicarbonate of Soda*, *Magnesia*, *Sulphate of Iron*, dilute *Sulphuric Acid*, and *Water*, which on being mixed would appear to give origin to the following changes. The free *Sulphuric Acid*, together with that existing in the

Sulphate of Iron, being just sufficient to decompose the *Carbonates of Soda* and *Magnesia*, forms two neutral *Sulphates*, (viz. *Sulphates of Soda* and *Magnesia*,) and thereby disengages a volume of *Carbonic Acid Gas*, which not only increases the purgative effects of the newly-formed saline compounds, but by its excess holds in solution the *Proto-carbonate of Iron*, arising from the decomposition of the *Sulphate* of that metal, and which in that state displays a very powerfully tonic influence. Dr. Barlow, in his valuable Essay on Gastrodynia, published in the Cyclopædia of Practical Medicine, (vol. ii. p. 332,) has given a somewhat similar formula, for *a Saline Cardiac* mixture, in common use at the Bath United Hospital, which may serve still further to illustrate the subject under consideration.*

469. We must not quit this subject without reminding the practitioner of the essential difference which exists between mechanical *mixture* and chemical *combination;* a difference which affects the medicinal virtues, no less than the sensible qualities of bodies. It has been determined by the most ample experience, that substances will produce effects upon the living system, when presented in a state of simple mechanical mixture, very different from those which the same medicinal ingredients will occasion when they are combined by the agency of chemical affinity. To illustrate this by a simple case,—a body suspended in a mixture in the form of a powder, will act very differently if held in solution by a fluid. The relative effects of alcohol in the form of what is termed

* The following is the formula for its preparation.

℞ Sodæ (*Sub*) carbonatis, ℥iß.
Aquæ puræ, Oviiß.
Acid. sulph. dilut. f℥j.
Confect. Aromat. ℥iij.
Spir. Menth. Piperit. ʒiij.

The foregoing quantities thus combined will yield 324 grains of *Sulphate of Soda;* 423 of the (*Sub*) *Carbonate* remaining unaffected by the acid. Thus will each ounce of the mixture contain but a few grains of either salt, and yet insignificant as the dose may appear it is not inert.

"*spirit*," and in that of wine, may be explained upon the same principle; in the former case, it is in a state of mixture, in the latter, in that of combination. It has been demonstrated beyond all doubt, that a bottle of port, madeira, or sherry, actually contains as much alcohol as exists in a pint of brandy; and yet how different the effect!—a fact which affords a very striking illustration of the extraordinary powers of chemical combination in modifying the activity of substances upon the living system. The composition and effects of mercurial ointment, as variously prepared, will also suggest some interesting points of inquiry with reference to this question. It will be remembered that, for a long time, this ointment was universally regarded as nothing more than an intimate mixture of the oxide with lard, effected by a protracted trituration of the metal with the unctuous body; and accordingly, with a view to abridge the labour of its preparation, the Edinburgh College directed the oxide to be at once mixed with the lard; Mr. Donovan, however, by a series of admirable experiments, rendered it evident that something beyond simple and intimate mixture took place in the process; he proved that, on melting the ointment, four-fifths of the metallic mercury subsided, leaving only one-fifth in the superior stratum; whence he concluded that the mercury exists in the ointment in two very different conditions—in the state of metal, *mechanically* mixed, as asserted by Vogel, and in that of an oxide, *chemically* combined with one or more of the organic acids of the lard; and to this latter portion alone did he attribute any medicinal power; the presence of metallic mercury not only being inert and useless, but actually injurious, by obstructing the absorption of this compound, the activity of which he ascertained by extensive trials. Mr. Donovan was accordingly induced to form a direct chemical combination, by continually agitating together lard and black oxide of mercury, at the temperature of 350° *Fah.* for two hours; and at the end of this process it appeared, upon examination, that every ounce of lard had dissolved and com-

bined with twenty-one grains of oxide; and from the trials which have been subsequently made with respect to the activity of this compound, it would seem to be as efficient as the officinal ointment; and moreover that it may be introduced by inunction in one third of the time. If this be true, we shall at once perceive the reason of the inefficacy of the "*Unguentum Oxidi Hydrargyri Cinerei*, now very properly excluded from the Edinburgh pharmacopœia; in short, it is a *mechanical mixture*, instead of a *chemical combination*. M. Guibourt, and more lately Mr. Watt, have however questioned the correctness of these views, the former having found not more than 1-500th part of the ointment to consist of a compound of mercury with a fatty acid, while the latter was very frequently unable to detect any. There must in these cases have been some error in the preparation of the ointment, for Dr. Christison tells us that "he has examined various samples during the last eight years, and has never failed to detect a sensible portion of oxide; he considers the average amount to be a little more than one per cent. of the ointment, and consequently a fiftieth of the mercury used in preparing it; and he thinks it is far from improbable that the small proportion of oxide, either present at first, or formed during the process of rubbing the ointment into the skin, is *the only active part*."

B. *The developement of Active Principles.*

470. There is scarcely any department of pharmacology upon which so much light has been thrown by the chemical discoveries of the last twenty years, as that which forms the subject of the present section. The active elements of bark, opium, ipecacuanha, and a long series of vegetable medicines of the highest importance, have been developed and separated by the wonderful power of chemical analysis, and successfully applied by the physician for the improvement of his art, and the extension of its resources; for although upon some occa-

sions I have deemed it necessary to question the advantage to be derived by exhibiting the *active element*, free from, and independent of, those principles with which it coexists in its native combination, I am by no means disposed to underrate the numerous valuable applications of which such isolated elements are capable; and however strongly I may have urged the importance of medicinal combination in the treatment of different diseases, I am very far from disallowing the claims of simplicity.

471. The developement of the active elements of compound bodies is more generally the result of pharmaceutical processes directed in our pharmacopœias, in order that such agents may be ready in the laboratory for the service of the prescriber; the examples of which are so familiar as scarcely to require enumeration: thus there are the VEGETABLE ALKALOIDS, *Morphia*, *Quina*, *Veratria*, &c.; VEGETABLE ACIDS, as the *Citric*, *Tartaric*, *Benzoic*, &c; and MINERAL ACIDS, as the *Nitric* and *Hydrochloric*, elicited from the compounds in which they exist. *Ammonia* is developed in its active and purgent form, from the inodorous *Hydrochlorate;* then, again, we have *Essential Oils* extracted from certain plants, in which they either exist in a free state, or in combination with resin, as in turpentine, and certain balsams.

472. Under certain circumstances the developement of the elements of activity may be the object of extemporaneous prescription; and on some occasions the medicinal efficacy and the act of decomposition may be said to be correlative; the most familiar example of which is the common effervescing saline draught. We have also a striking instance in the extemporaneous plaster, (*Form.* 17,) so valuable for curing the swelling of the bursæ of the patellæ, a disease common to housemaids, in consequence of kneeling to scour floors; it is composed of *Hydrochlorate of Ammonia*, *Soap*, and *Lead Plaster*, in which the alkali of the soap, by slowly entering into combination with the hydrochloric acid, liberates the ammonia in a gaseous form, which being dissolved as it arises

by the moisture of the skin, keeps up a rubefacient and stimulating influence. The *Cataplasma Fermenti*, or *Yeast Poultice*, furnishes a parallel example, since its antiseptic properties are not derived from any virtue in its ingredients, but from the reaction of its elements, and the consequent developement of carbonic acid gas. In like manner, a powder composed of one part of *Alum* and four parts of *Carbonate of Zinc*, affords a useful application to certain ulcerated surfaces, and is used by veterinary surgeons with great effect when sprinkled over abrasions, ulcerated heels, &c.; upon its contact with moisture this powder is decomposed, a *Sulphate of Zinc* is formed, the astringency of which is modified by that portion of the *Carbonate of Zinc* which remains unchanged, while the evolved *Carbonic Acid Gas* corrects the fœtor of the ulcer. (*Morton's Veterinary Pharmacy.*) The antiseptic agency of the *Calx chorinata*, by the contact of an acid, is to be similarly explained, *viz.* by the developement of *Chlorine*. The practitioner unacquainted with the theory of such operations would fall into an error, by which their efficacy would be lost; he would probably not be led to apply them as soon as they were prepared, nor would he be aware of the necessity of renewing them at intervals.

473. In the decomposition of *Calomel* by *Lime-water*, we develope the *Oxide of Mercury* of the pharmacopœia, and *Chloride of Calcium*, constituting the valuable "*Black Wash*" of the surgeons; and in decomposing *Corrosive Sublimate* by the same solution, we obtain the *Binoxide* of the metal, and the resulting mixture is known by the name of *Aqua Phagadenica*. In both these cases we derive the peculiar efficacy of the preparation from the developement of the mercury in different states of oxidation.

474. A substance directly separated by *chemical* precipitation is often more efficient, in consequence of its subtle and impalpable form, than a body in other respects similar, but which has been *mechanically* reduced into powder; for example, the carbonate of lead, when diffused in water is, according to the

experience of our more experienced surgeons, far less active as a topical application, than the same substance when extemporaneously produced by precipitation from the diacetate of that metal. For a similar reason it has been supposed that the diaphoretic effects of guaiacum are best insured by its precipitation from the tincture. In some cases also, it must be observed, that the substances obtained by precipitation is in a different state of oxidation from that which is prepared by other methods. The *Hydrargyri Oxidum* obtained by precipitation from calomel by lime water, and subsequently mixed with chalk, is more efficient than the *Hydrargyrum cum creta* of the pharmacopœia, formed as it is by trituration. For similar reasons, the *Proto-carbonate of Iron*, as existing in the *Mistura Ferri composita*, is more active than the carbonate of the metal produced by any other process. Dr. Macmichael of Dublin has offered the following interesting remarks upon this subject in his valuable lectures. In his opinion, the best mode of exhibiting the *Carbonate of Iron is at the moment of its precipitation;* the formula is, to add to one drachm of the bicarbonate of soda, dissolved in four ounces of spring water, a drachm of the muriated tincture of iron; the draught to be taken in the state of effervescence. Although the quantity of carbonate of iron thus formed is not considerable, yet it is in such *a state of minute subdivision*, that it will answer the object of a chalybeate much better than the ordinary dose of one or two drachms, as generally prescribed; add to which, there will be present a small quantity of *Chloride of Sodium*, which is a salt most congenial to the system of red-blooded animals." For similar reasons it has been questioned whether a more uniform and certain preparation than that of the *Antimonial Powder* might not be obtained by at once precipitating the oxide from the potassio-tartrate of the metal.

475. Amongst the most interesting of recent chemical discoveries, is the fact that certain bodies which had long been regarded as *Educts*, separable from the vegetable substances in which they were supposed to pre-exist as constituent parts,

are actually *Products*, or new compounds, formed by the reaction of the original principles upon each other, by the concurrent aid of water; thus, for example, the volatile oil of mustard, upon which the pungent character of that substance depends, is created, not developed; it is actually called into existence by the action of one of its principles, termed *Myrosine*, upon another, to which the name of *Sinapisin* has been given, the moment that water is added to the farina of the mustard seed. In a similar manner, the volatile oil of bitter almonds, so far from being an ingredient of the nut, which is merely volatilized from it by the act of distillation, is a new *Product*, generated at the instant by the operation of its *Emulsin* upon its *Amygdalin*, the former acting upon the latter just as yeast does upon sugar and water, in the fermentation of spirit. Were this subject diligently and scientifically pursued, there can be but little doubt that many other similar instances might be discovered. It seems probable that the aromatic principle, and consequently the characteristic properties of roasted coffee, is a volatile oil, generated during torrefaction, although we are unable to point out the particular principles existing in the raw coffee from which it is produced.

C. *By combining substances between which no other chemical change is induced than a diminution, or increase, in the* SOLUBILITIES *of those principles which are the repositories of their medicinal virtues.*

476. The degree of solubility possessed by a medicinal substance may, very probably, be regarded by many practitioners as a circumstance of but little or no consequence; it is, however, of far greater importance than a superficial view of the question could lead us to suppose; indeed, it would appear that, in many cases, *it not only influences the activity of a remedy, but like its dose goes far to determine its specific operation;* in fact, whenever a medicine is not in itself very soluble, the increase of its solubility is tantamount to an increase of

its dose. So greatly does insolubility disguise the sensible qualities of a body that, judging only by such a test, we should pronounce the antacid powers of magnesia as being very far less than those of potass, for the former scarcely displays any alkaline reaction; and yet the chemist will demonstrate that twenty parts of this earth will neutralize as much sulphuric acid as forty-eight parts of potass.

477. To the diversity which exists in the solubility of the active elements of certain purgatives, we may in some measure ascribe the diversity which occurs in their operation; it is for instance, easy to imagine that a medicine may act more immediately and specially on the stomach, small, or large intestines, according to the relative facility with which its principles of activity enter into solution; for a body in its solid state can present only a very small portion of its surface to the mucous membrane; hence those which are dissolved before they pass the pylorus may be quick and violent in their effects, and more liable to affect the stomach, as is exemplified by the action of *Camboge*, whilst other resinous purgatives, since they contain principles less soluble, will seldom act until they have passed out of the stomach, and often not until they have traversed a considerable surface, and reached the colon. *Colocynth* has a wide range of operation, in consequence of its active principles residing in comparatively soluble and insoluble matter; but *Aloes* being farther insoluble, pass through a large space of the alimentary canal before they are sufficiently dissolved, and therefore act more particularly on the rectum; in consequence of which they are liable to occasion piles, tenesmus, and the various effects which characterise their action. The effects of *Rhubarb*, *Senna*, *Saline Cathartics*, and indeed those of most of the individual substances of this class, if examined with reference to this principle, will admit of a satisfactory explanation. The application of these views, if they are true, ought to enable the practitioner, by changing the solubility of a substance, to modify its medicinal effects. Experience has shown that such is the fact, and that

it may be effected either *by the intervention of substances that act* CHEMICALLY, or *by the addition of ingredients whose operation is* MECHANICAL; thus, by combining *Aloes* with soap, or an alkaline salt, we quicken their operation, and remove their tendency to irritate the rectum; the *Compound Decoction of Aloes* affords a combination of this kind, which operates very differently from the solid drug. *Camboge*, whose too ready solubility it is an object to obviate, should be intimately incorporated with some less soluble purgative, as, for instance, *Aloes;* a purgative of this kind was introduced into practice by Dr. George Fordyce, and it has since been simplified and admitted into our pharmacopœia, under the title of *Pilulæ Cambogiæ Compositæ.** Under the consideration of the subject of pills, the practitioner will receive many practical remarks in further illustration of this subject. *Tartrate of Potass*, which, on account of its ready solubility, has acquired the name of *Soluble* tartar, acts with corresponding briskness upon the intestines, but by doubling its proportion of tartaric acid we convert it into a *Bi*-tartrate, or *Cream of Tartar*, which is characterised by a comparative degree of insolubility, and a corresponding change is produced in the medicinal activity of the salt; for unless it be given in very large doses, its purgative effects are scarcely perceptible, while it acquires considerable power as a diuretic, probably from the elimination and absorption of its base. We may even extend this experiment by adding *Boracic Acid* to the *Cream of Tartar*, a substance capable of increasing its solubility by converting it into a

* MORRISON'S PILLS. This nostrum, of which we have heard so much, is nothing more than the above pill, with the unimportant addition of a small portion of cream of tartar. If, however, we examine a box of them, we shall find that they vary very considerably in hardness, some being perfectly soft, while others are as hard as marbles. This may have been purposely effected by drying or baking them, in order that a greater number of them might be taken without a corresponding effect; but it may so happen that the unlucky patient shall take more than a due proportion of the softer variety, and hence the most violent effects may follow their use.

Boro-tartrate, when we shall find that its purgative properties are restored in an equal proportion. (134.) Every substance that is to be absorbed, in order to produce its medicinal effect, must necessarily be presented in a requisite state of dilution, or be rendered so by the solvent powers of the stomach. Liebig has observed that very concentrated saline solutions are incapable of penetrating the animal membranes; this is perfectly true, nor will they act upon the bowels until they have extracted sufficient water in their transit; and to the readiness with which they effect this, we may attribute the thirst which usually attends their action when not given in a sufficiently diluted form. If this dilution, however, be carried to a considerable extent, and the dose be not considerable, their absorption takes place, and the purgative influence is diminished, and the action of the kidneys increased; thus it often happens that persons, on first taking the weak saline aperient waters at Cheltenham, are troubled by an inordinate discharge of urine, which is easily stopped by adding some additional sulphate of magnesia to the water.

478. It has been observed that a mixture of different saline cathartics is frequently more active than an equivalent dose of any single one, a fact which is exemplified in the prompt and active operation of sea-water, and that of various saline springs. Dr. Christison has given us a formula in his dispensary which affords a good example of this form of combination. It consists of equal parts of *Sulphate of Magnesia*, and of the *Potassio-tartrate of Soda;* two or three drachms of which in six ounces of tepid water will act mildly, effectually, and pleasantly. By combining the solutions of *Sulphate of Magnesia* and *Sulphate of Soda*, we obtain a *Sulphate of Soda and Magnesia*, a double salt which may be sometimes detected in parcels of Epsom salts by its crystals, which are regular rhomboids. It is soluble, and acts pleasantly.

479. Whenever the active principles of a cathartic is not sufficiently soluble, it is apt to vex and irritate the bowels, producing tormina, rather than exciting a free and copious

excretion; hence the reason why the operation of resinous purgatives is so commonly attended with griping, and why relief may be obtained by combining them with neutral salts; thus also is *Senna*, whose virtues reside in matter which is liable, by decoction or long exposure to the air, to become less soluble, very apt to produce griping.

480. The influence of solubility upon the medicinal energies, and specific effects of remedies, may be further illustrated by an examination of the comparative merits of the *Acetate* and *Diacetate of Lead;* the former will retain its solubility and integrity under any degree of dilution with distilled water, while the latter, (*Goulard's Extract,*) in consequence of the carbonic acid which is diffused through the purest water, cannot be diluted without a precipitation. The *Acetate* is therefore the more immediately active preparation, but it is nevertheless on some occasions less adapted to relieve inflammation than the turbid mixture of the *Diacetate*, since the slow and gradual action of the latter may be more desirable than the more transient operation of the former; the popular injection for gonorrhœa, consisting of the mixed solutions of *Sulphate of Zinc*, and *Acetate of Lead*, may probably owe much of its value to the less soluble precipitate which, by adhering to the moist membranous surface of the urethra, keeps up a more permanent action than the soluble salt could maintain; and this may perhaps explain the apparent anomaly observed by Dr. Thomson, with regard to the *Carbonate* of lead being more apt to produce cholic than the *Acetate* of that metal; it is, however, possible that this salt may be soluble in the fluids of the stomach, and therefore poisonous; in the same way that the *Protoxide of Iron*, the *Chloride of Silver*, and various other bodies, are so dissolved.

481. The insolubility of *Magnesia*, as an antacid, confers upon it advantages not possessed by the more soluble alkalies, as already explained. (244.)

482. In the exhibition of solid substances, their mechanical state of division, as affecting their solubility, may modify their

medicinal effects; although I am not disposed to assign to it the importance which Gaubius has ventured to express: *Sunt quæ ruditer pulverata alvum, subtilius vero urinas, aut alios humores moveant;*" and Ray, in speaking of the *Asarum*, (*Hist.* p. 208,) has the following remark: "*Quo tenuius est tritum, eo magis urinas movere, minus autem alvum ducere creditur.*" Linnæus also observes that the same plant, when exhibited in the state of *very fine powder*, uniformly acts as an emetic, but that when *coarsely powdered* it always passes the stomach, and becomes cathartic. M. Virey has made a similar observation with respect to hellebore, "*L'Hellebore pulvèrisé fait vomiter; concasse, il purge, et en décoction prolongée, il en devient sudorifique, ou diurétique.*" There can be no doubt that bodies in a state of coarse powder are liable, from a mechanical action, to occasion a relaxed condition of the bowels. (115.)

483. In remedies composed of vegetable tonics, the useful application of this principle is also apparent; thus the addition of alkalies or lime-water to the infusion of calumba,* and some other bitters, by rendering certain vegetable principles more soluble, increase their efficacy; although there exist some important exceptions, as will be hereafter stated.

484. The influence of solubility, as affecting the poisonous energy† of virulent substances, has already been considered;

* The principle CALUMBIN is dissolved without any chemical change in the caustic alkalies.

† The most subtle of all poisons,—*the matter of febrile contagion*,—is certainly modified in activity by the degree of moisture in the atmosphere influencing its solubility; the plague is said to be most common in Egypt after the inundation of the Nile, a period at which the atmosphere is necessarily saturated with water. According to the account of Sir Robert Wilson, the English and Turkish armies that marched to Cairo escaped contagion, while the troops that remained stationary on the moist shore of Aboukir were very severely visited. On the other hand, the *harmattan*, a wind experienced on the western coast of Africa, between the Equator and fifteen degrees *north latitude*, blowing from north-east towards the Atlantic, and which in consequence of its passage over a very extensive space of arid land, is necessarily characterized by excessive

(272;) and it has also been seen under what circumstances it may be admissible. When these active substances are administered as remedies in small doses, the precept respecting their solubilities is most important, for in such cases the smallness of the quantity places their operation more immediately under the control of various incidental agents: only destroy the solubility of such a medicine, and the chances are that you will divest it of those powers which render it useful; at the same time let it be known, that there are bodies which, although insoluble in the vessels of the chemist, may be soluble in the laboratory of the living stomach; but these are exceptions to a general rule. Dr. Christison has shown that *Arsenic* acts through all its forms of chemical combination nearly in the ratio of its solubility; thus, insoluble *Iodides* are not poisonous; the *Acetate of Lead*, as a remedy, is rendered inert by combination with *Sulphuric Acid*. It is also known that the *Tannic* and *Gallic Acids* are capable of combining with the *Oxide of* any of the soluble salts of lead, and of precipitating it in a perfectly insoluble form; hence all liquors which

dryness, puts an end to all epidemics, as the small-pox; and infection at such a time does not appear to be easily communicable even by art.—*Philosophical Transactions*, Vol. XXI.

The difficulty of communicating infection to animals during a dry state of the air, as remarked on the western coast of Africa, during the blowing of the *harmattan*, agrees with some observations on plague by the French physicians, as this complaint first made its appearance in the French army during a moist state of the air in Syria, when it lay under the walls of Jaffa, in February, 1800.

It is a well-known fact that volatile bodies are sooner converted into a gaseous state by the presence of water in the atmosphere; this is strikingly exemplified by the greater rapidity with which *limestone* is burnt and reduced to quick lime in moist weather, and by the assistance which is rendered in a dry season, by placing a pan of water in the ash-pit; so again the perfume of flowers is most sensible when the air is humid, as during the fall of the evening dew, or in the morning when the dew evaporates, and is dissipated by the rays of the rising sun; for the same reason the stench of putrid ditches and common sewers is conveyed to the organs of smell much more speedily in summer previous to rain, when the air is charged with moisture.

have been kept in oaken casks will be free from any lead which they might have originally held dissolved. We have thus a theory ready to explain the deleterious effects of *new* rum in the West Indies.*

485. I cannot conclude the subject of solubility without relating an anecdote which may tend to illustrate and confirm the truth of the views I have offered with respect to its importance. It presents us with an empirical practice, independent of theory, and consequently the most valuable of all testimony. The American Indians, as we are told, whenever they undertake a long journey, and are likely to be destitute of provisions, employ tobacco as the means of counteracting the cravings of hunger; and in its preparation for such an object, they adopt an expedient for modifying its powers, and protracting its effects, which will afford a very instructive illustration of the influence which may be derived from a modified solubility. The practice consists in mixing the juice of the tobacco with the pulverised shells of snails, cockles, and oysters;† the mass is dried, and made into pellets of a convenient size to be held between the gum and the lip, which being in this manner gradually dissolved and swallowed, fulfils the required intention.‡ We have adopted a similar

* Newly distilled rum is found to contain traces of lead derived from the leaden rims of the boilers, and the leaden worms of the refrigeratories; but after having been kept twelve months in oaken casks, it loses its deleterious properties, and no longer exhibits any traces of this metal. Sir George Baker considered the "*dry belly-ache,*" so common to the drinkers of new rum, to be entirely referrible to its contamination with lead.

† They are first calcined, but not burnt to lime, the operation being only carried to such an extent as may destroy their tenacity, and render them fit for levigation.

‡ A similar custom is common to the Indians of the whole of Asia and of America; for the practice of the South American Indians, see *Humboldt's Personal Narrative.* In India *Betel* variously compounded is employed for the purpose above stated. The mixture more commonly used in Ceylon consists of quicklime, areca-nut, and tobacco wrapped in the betel leaf. On ordinary occasions it is only masticated, but to repress the painful calls of hunger the juice is swallowed. Sir Walter Scott in-

expedient for modifying the solubility of some of our medicines: for example, of camboge by aloes, in the *Pil. Cambog. co.*; of opium by styrax, in the *Pil. Styracis co.*; or by sulphate of potass, as in the *Pulvis Ipecacuanhæ co.*, and in the *Pilulæ Opii* of the Edinburgh Pharmacopœia.

486. The application of these precepts regarding solubility is highly important in practice. We have seen that we may be thus directed in the election of a purgative, according to the objects we may desire to fulfil by it; while it will enable us, on many occasions, to increase or to diminish, to retard or to accelerate their operations; it may moreover lead us to the construction of new and powerful arrangements, by imparting to established remedies fresh activity, or by mitigating the violence of others, in every respect efficacious and eligible. By the addition of sugar we are enabled to obtain a much stronger solution of lime in water;* and the solubility of camphor is increased by its triture with magnesia. We also increase the solubility of quina by the action of sulphuric acid, and that of the ammonia-sulphate of copper by ammonia. Acetate of lead is kept in solution by acetic acid; and should we exhibit the disulphate of quina in the compound infusion of roses, the addition of sulphuric acid will prevent its precipitation by the astringent principle. We have already alluded to the manner in which the solubility of benzoic acid may be enhanced, (329,) without any loss of its specific power. It will likewise afford us some useful hints connected with the successful administration of certain remedies that may require dilution to promote their operation, and of those whose too speedy and violent effects may be retarded and checked by diminished potation; thus, in the exhibition of diuretics, likely to become cathartic, or diaphoretic, no

forms us that General Monk, not being able to procure any supper at Coldstream, was fain to have recourse to the chewing tobacco to appease his hunger.

* A solution of sugar at 50^0 is able to dissolve one half of its weight of lime.

liquid should be given for at least an hour after their administration; the same caution will apply to the compound powder of ipecacuan, should it have tendency to excite vomiting; although in both these cases, after a certain interval, sufficient to allow the remedy to pass out of the stomach, the ingestion of liquids may, and in some cases ought to be encouraged. To Sir Francis Milman we are much indebted for some valuable hints concerning the importance of accompanying the exhibition of *Diuretics* with plentiful dilution.

V.

TO AFFORD AN ELIGIBLE FORM.

A. *By which the efficacy of the medicine is enhanced.*

487. After the views which have been submitted during the progress of our inquiry, it must be evident that the *form* in which a remedy is exhibited may influence its efficacy. A decoction and infusion of the same vegetable substances will materially differ in activity, according to the chemical composition of the body which is subjected to the process. In the selection of the form of *pill*, *powder*, or *mixture*, we shall have to take into account the influences of mechanical aggregation, and chemical solution. Dr. Powel (*Med. Trans.*, vol. iv. p. 92) was able to give fifteen grain doses of nitrate of silver in pills, while the stomach would rarely bear more than five when in solution. I merely quote this fact in illustration of my subject, not in commendation of the practice. In some cases it would appear that the efficacy of a medicine may be enhanced by its being presented in such a state of mixture as will keep it for some time in contact with the alimentary membrane; for the same reason that the *Sesquioxide of Iron* is found to be more efficacious as an antidote to arsenic, when exhibited in the form of *Magma*. (272.) I have thought that I have found the *Trisnitrate of Bismuth* to be more efficacious

in gastric affections, when suspended in a mixture, by means of mucilage, (*Form.* 53,) than when given in the state of pills; and I suspect that the virtues of the *Mistura Ferri Composita* are in certain cases (232) not independent of the mechanical state of the *Proto-carbonate.* The same observation will apply to several other remedies, especially to the *Extract of Conium,* when given as a sedative in pulmonary irritation, for ample experience has perfectly satisfied me that this substance is much more efficient when suspended in a mixture, than when given in the form of pill.

488. When a substance, or a combination of substances, requires any addition for the purpose of imparting convenience or efficacy of form, *a vehicle should, if possible, be selected, whose effects will correspond with the intention of the other ingredients.* This precept will be found exemplified in *Formulæ* 60, 62, 93, 106, and some others, the KEY *letters* of which point out the *modus operandi* of their respective vehicles.

B. *By which its aspect or flavour is rendered less objectionable.*

489. It should ever be our object to accommodate, as far as we are able, the form and flavour of our medicines to the taste and caprice of the patient, whose prejudices should never fall coldly upon the ear of the physician; for such is their influence upon the body, that by a little address they may often be enlisted into our service, while by opposing them they are rendered formidable obstacles to our plan of treatment. Not that we advocate the slightest concession by which the virtues of a remedy are sacrificed to its taste or appearance. Such a compromise is discreditable to the physician, and derogatory to his art; and yet I have known numbers of our profession who, rather than shock the delicate nerves of their patient, would suggest even the use of an umbrella in the shower-bath. Patients do not readily under-

stand that the unpleasant operation of a medicine is frequently essential to its beneficial operation; and they often entertain ungrounded prejudices against particular medicines, averring that, "after repeated trials, they are satisfied they do not agree with their constitutions." Should, however, the obnoxious medicine be necessary for the cure, the practitioner is not to be deterred from its use, although he may be justified in concealing its exhibition. The flavour and odour of opium are often so objectionable as to preclude its use; in such a case, styrax and saffron will so completely disguise them that it may be very safely exhibited in the form of *Pil. Styracis comp.* without exciting the least suspicion. The nauseous flavour of an alkaline solution is disguised by a bitter infusion, or still better by table-beer. (*Form.* 169.) Acids are sheathed by mucilage; castor oil and copaiba have been sometimes exhibited in the form of an emulsion, by diffusing them in soft or distilled water, by means of the yolk of egg, or mucilage. (*Form.* 97, 102, 103.) Another method of disguising their nauseous properties, consists in pouring the castor oil, or copaiba, on the surface of water, and afterwards dropping slowly round the rim of the vessel some bitter tincture; by which means the oil or balsam will, in consequence of the union of the spirit with the water, be collected and concentrated into a single globule in the centre, which may be easily swallowed, while the taste will be entirely masked by the bitterness of the vehicle. M. Mothes, of Paris, devised a plan for exhibiting these, and other bodies, in a thin capsule* of gelatin, which is dissolved in the stomach. With the view of rendering copaiba less objectionable to the patient, we have heard of various *nostrums* advertised under the name of "*Specific Solutions.*" They are generally made by dissolving the copaiba in an alkaline solution, and adding to it the spirit

* The process for making these capsules has been kept secret, but Dr. Christison has lately given directions for their preparation in his dispensary.

of nitric ether.* The bitterness of gentian is in great measure so subdued, as to reconcile the patient to its use, by the addition of aromatics, as in the *Infus. Gentian comp.* The infusion of senna, as far as relates to its flavour, is less objectionable when made with bohea tea. (*Form.* 93.) The taste of lime-water is best covered by milk. To disguise the taste of most medicines, or to render them more acceptable, it is a general practice to add syrup; this is entirely a matter of taste, for which it is impossible to legislate, although it may be observed that in some cases the draught is rendered still more nauseous by such an addition; while in others it is exposed to chemical objections which will be explained in the following section. (492.)

490. Some medicines are more grateful to the stomach, as well as more efficacious in their operation, when exhibited in the state of effervescence. To effect which we have only to introduce an alkaline bi-carbonate into the formula, and to direct a portion of some acid to be added just before the draught is taken; I need scarcely remark that, in such a case, care must be taken that the ingredients are of a nature not to be decomposed by the alkali in the first instance, nor, in the second, by the neutral salt resulting from the combination. (*Form.* 150, 157.)

C. *By which it is* PRESERVED *from spontaneous decomposition, or any other chemical change.*

491. It is frequently advisable to add some ingredients for the purpose of checking the spontaneous changes to which a

* Dr. Christison has furnished us with the following formula, which is in use in Edinburgh. "Boil gently for fifteen minutes two ounces of copaiva with two ounces and a half of aqua potassæ; add when nearly cool an ounce of spirit of nitrous ether; and when the mixture has been at rest for twelve hours, remove the intermediate liquid from the soapy sediment which falls, and the lighter fluid which floats on the surface. In this case a part of the volatile oil seems to be separated, and most of the resin deposited in the form of soap."

medicine may be prone. To secure such an object, sugar has been long held in very general estimation, as implied by the popular term *conserve;* but until lately its powers were supposed to be only applicable to subjects of the organic kingdoms,—to the preservation of vegetable and animal* substances: it has been thus extensively used for preserving meat, as well as fruit, and it has been added to fats and oils to prevent their becoming rancid; it is for this purpose that Dr. Jenner recommends the addition of white sugar to his ointment of *Potassio-tartrate of Antimony.* Its conservative power, however, is now known to extend to objects of the mineral kingdom; certain metallic oxides, for example, are thus preserved from further oxidation. It is generally admitted that the only method of preserving the *Iodide of Iron*† from chemical change is to form it into a syrup, and the Edinburgh College has therefore, in the latest edition of its pharmacopœia, very wisely introduced a formula for the preparation of the "*Syrupus Iodidi Ferri.*" It has been long a desideratum to obtain some means by which the recently precipitated *Proto-carbonate of Iron* might be prevented from passing into the state of *Sesquioxide;* Dr. Clarke of Aberdeen proposed to form it at once into an electuary, by which he thought it would be preserved from the action of the air; but Klauer, in adopting this expedient, proved that the sugar exerted an influence beyond that of mere mechanical protection, for he found that the protoxide was thus prevented from combining with any additional oxygen, even though it were dried with the aid of a gentle heat; and Dr. Christison had previously observed that, when thus formed into an electuary, the metallic compound did not part with its carbonic acid, however thoroughly it might have been dried. The result of

* Milk boiled with fine sugar will keep for a great length of time, and might be conveniently employed during a long voyage; and raw meat might be preserved in treacle.

† Some very interesting practical observations upon this subject will be found in the transactions of the Pharmaceutical Society.

these researches has been to establish an important chemical fact of general application, and to introduce, in particular, a formula in the Edinburgh Pharmacopœia for the preparation of a saccharine carbonate of iron. ("*Ferri Carbonas Saccharatum.*")* Vogel has published a paper to show the chemical effects exerted by sugar upon various metallic oxides and salts; in some cases reducing the oxide to a state of metal, and in others depriving the oxide of only one proportional of its oxygen. Such facts are of great interest to the pharmaceutic chemist.†

492. In consequence of the fermentation to which syrups are liable, there are many objections to their use; they should never, for instance, be introduced into draughts which are likely to be injured by the generation of an acid; I have frequently seen the common *Cretaceous Mixture*, when charged with syrup, disengage such a volume of carbonic acid, as to occasion the explosion of the phial in which it was contained; the syrup of poppies is particularly liable to such an objection; a medicine, therefore, given with a view to check a diarrhœa, will under such circumstances increase the evil it was intended to correct. In like manner, the addition of syrup to the infusion of catechu, as directed by the college of Edinburgh, although it may cover its taste, will as certainly prevent the preparation from keeping beyond a day or two, whereas, without the syrup, it may be preserved for as many months.

493. Vegetable preparations susceptible of mouldiness are best preserved by the addition of aromatics. Dr. M'Culloch, in a very interesting paper published in the Edinburgh Phi-

* Mr. Redwood has proposed to exhibit recently prepared carbonate of iron inclosed in the gelatine capsules to which we have just alluded. (*Pharm. Trans.* No. II.)

† Sulphate of copper, and nitrate of mercury, by being boiled with sugar, are precipitated in the metallic form; whilst peroxide of mercury, and acetate of copper, are converted into protoxides. Corrosive sublimate is changed into calomel, but calomel is not susceptible of any further decomposition.

losophical Journal, has observed that perfumes, such as essential oil, &c., will prevent the production and growth of those minute cryptogamia, upon which the phenomenon of mouldiness depends.*

494. It is scarcely necessary to observe that spirit is very commonly added to vegetable infusions and decoctions, for the purpose of arresting their spontaneous decomposition; it is for such an object that the compound tincture of cinnamon is introduced into the *Decoct. Aloes comp.* In the preservation of "*Distilled Waters*," the pharmacopœia now directs a small quantity of spirits to be distilled with the water, in preference to being subsequently added to the product.

495. By the assistance of chemical knowledge, the practitioner will also be taught to avoid the introduction of all such ingredients in his prescriptions as may have a tendency to accelerate decomposition. Some allusions have been already

* The plant is propagated by seeds infinitely small. Reaumur found the interior of an addled egg mouldy; hence they must have passed through the pores of the shell. Dr. M'Culloch states that ink, paste, and seeds, are amongst the common articles which suffer from such a cause, and to which his remedy is applicable. With respect to articles of food, such as bread, cold meat, or dried fish, it is less easy to apply it, on account of the taste; cloves, however, and other spices, whose flavours are grateful, may sometimes be used for this end. It is notorious that gingerbread, and bread containing carraway seeds, are far less liable to become mouldy than common plain bread. The effect of cloves in preventing the mouldiness of ink is well known; and the same result may be obtained by oil of lavender, in a small quantity, or by any other of the perfumed oils. Russian leather, which is perfumed by the tar of the birch tree, is not subject to mouldiness, as must be known to all who possess books so bound; they even prevent its taking place in those bound in calf, and near which they may happen to stand. Paste is another perishable article, and although alum, which is used by the bookbinder, will certainly preserve it longer than it would remain useful without it, still it is not very effectual. Rosin, used by the shoemaker, answers the purpose much better, and appears to act entirely upon this principle; it is, however, far less effectual than even oil of turpentine, and lavender; the other strong perfumes, as peppermint, anise, and bergamot, are perfectly effectual, even in very small quantities, and paste may be thus preserved for any length of time.

made to this subject. (p. 128.) *Gallic Acid*, and the various vegetable astringents which contain it, may be dissolved in water, and remain for some time unaltered, as I have just noticed; but if the smallest quantity of a free alkali be present, such infusions will acquire the property of attracting oxygen, and of being converted into a brown extractive matter, frequently evolving at the same time a volume of carbonic acid. *Corrosive Sublimate* is hurried into decomposition by sugar, oil, gum, extractive, and other organic matter; on which account, if administered, as is usual in the decoction of sarsaparilla, the mixture ought not to be long kept, but be regarded as extemporaneous.

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496. Such are the objects which may be obtained by combining several medicinal substances in one *single formula;* and such are the principles which are to direct and regulate the combinations; but, once for all, let it be distinctly and unequivocally understood that, unless a physician can satisfactorily explain the operation of each element in his prescription by a reference to one or more of the principles above enumerated, SIMPLICITY should ever be regarded as the greatest desideratum. "*Quod uno vales efficere, ne tentes pluribus;*" so says Gaubius, and every experienced practitioner will readily assent to the aphorism. I was once told by a country practitioner, that the quantity, or rather complexity of the medicines which he gave his patients, for there never was any deficiency in the former, was always in proportion to the obscurity of the case. "If," said he, "I fire a profusion of shot, it is very extraordinary if some do not hit the mark." Sir Gilbert Blane has given us a similar anecdote. (*Medical Logic.*) "A practitioner being asked by his patient why he put so many ingredients into his prescription, is said to have answered more facetiously than philosophically, '*In order that the disease may take which it likes best.*' By a similar species of logic, Ziviani advises a mixture of animal and vegetable

diet in cases of flatulency, "*because it is not yet determined which of the two is the more flatulent!*" A patient in the hands of such a practitioner has not a much better chance than the Chinese mandarin who, upon being attacked with any disorder, calls in twelve or more physicians, and swallows in one mixture all the potions which each may have separately prescribed. Let not the young practitioner, however, be deceived; he may be assured that, unless he be well acquainted with the mutual actions which bodies exert upon each other, and upon the living system, it may be laid down as an axiom, that *in proportion as he complicates a medicine, he does but multiply the chances of its failure.* SUPERFLUA NUNQUAM NON NOCENT. Let him cherish this maxim in his remembrance, and in forming compounds, always discard from them every element which has not its mode of action clearly defined, unless indeed, as we shall hereafter explain, a general and paramount experience shall have stamped upon it the authentic seal of approval.

497. There is this marked distinction between the raw and well-disciplined practitioner, that while the one, seeing only a variety of unconnected symptoms, seeks to attack each by a separate ingredient in his prescription, the other, by being enabled to group together such as arise from a single cause, diminishes in number and variety the points to be attacked, and simplifies his remedies in the same ratio.

498. The perfection of a medicinal prescription may be defined by three words. It should be PRECISE, (in its *directions*,) CONCISE, (in its *construction*,) DECISIVE, (in its plan of *operation*.) It should carry upon its very face an air of energy and decision, and speak intelligibly the indications which it is intended to fulfil. It may be laid down as a maxim, which is not in much danger of being controverted, that *where the intention of a medicinal combination is obscure, its operation will be imbecile.*

499. A medicinal formula has been divided into four constituent parts, a plan which will be found to admit of useful

application to practice, inasmuch as it is well calculated to point out the methods by which we may accomplish the objects investigated in the preceding pages; or, in the language of Asclepiades, by which we may enable the basis of our prescription to operate, "CITO," "TUTO," et "JUCUNDE;" quickly, safely, and pleasantly, thus:—

I. THE BASIS; or principal ingredient.—("*Curare.*")

II. THE ADJUVANS; that which assists and promotes its operation. ("*Cito.*")

III. THE CORRIGENS; that which corrects its operation.—("*Tuto.*")

IV. THE CONSTITUENS; that which imparts an agreeable form.—("*Jucunde.*")

500. These several elements, however, are not all necessarily present in every formula, since many medicines do not require any addition to promote their operation; and the mild and tractable nature of others renders the introduction of any corrective unnecessary, while some, again, are in their nature so manageable as not to require the interposition of any vehicle, or constituent. It moreover frequently occurs that one element is capable of fulfilling two or more of these objects; the ADJUVANS, for instance, may at the same time act as the CORRIGENS, or CONSTITUENS; thus the addition of *Soap* to *Aloes*, or *Extract of Jalap*, mitigates their acrimony, at the same time that it quickens their operation. So, again, *Neutral Salts* both quicken the action and correct the griping that so commonly attends the operation of *Senna*, and certain resinous purgatives. It has been stated that styrax disguises the flavour of opium, (489,) it also modifies its power, and thus, as exemplified in the *Pil. Styracis comp.*, acts as an *adjuvant* as well as a *corrigent*. The propriety of selecting a vehicle that will best correspond with the intention of the ingredients to which we desire to impart a convenience or efficacy of form, has been already explained, (488,) and the disposition of the several KEY-LETTERS which are placed opposite the different ingredients, which compose our illus-

trative formulæ, will afford various examples of this coincidence, which, if possible, should always be attained, for it simplifies the formula, and by decreasing the bulk of the remedy, renders it less objectionable.

501. This division of the formula affords also the best general rule for placing its ingredients in proper order, for the order should correspond with that of the arrangement; the basis should stand first, and the other elements follow in succession; and should there be more than one of such elements, those intended to act in unison should be marshalled together. This may be better understood by referring to the *Formulæ;* for example, in *Form.* 4, the basis is the *Infusion of Cloves;* then follow in succession three tinctures, each of which is intended to act as an *adjuvant;* the syrup of ginger, while it imparts a grateful flavour, coincides with the general object of the combination. To this general rule of arrangement, however, there are some important exceptions. The first object of the prescriber should be so to guide the dispenser of his medicines, as to insure the accuracy of their composition; thus the volatile ingredients should be those last added, and therefore the last enumerated in the prescription; for example, in the first formula, it will be seen that the æther is placed last, although theoretically it should have stood first, as being the basis, or article of the greatest power; so, again, in *Form.* 30, 33, in which, had the general rule been followed, the æther might have been volatilized and lost during the process of preparation. Should any of the ingredients require a previous manipulation to render them miscible, the *constituent*, or *intermede*, must be placed next the particular ingredient to which it is intended to impart convenience or efficacy of form, as may be seen in *Form.* 2, 6, 5, 97, 102, 103, 104, 153. Suppose that the basis of a formula be a powder, or a precipitate from a tincture, which is to be administered together with several other articles in the form of a draught; in that case we should arrange the ingredients in an order which it would be necessary for the dispenser to

observe, with a view to obtain an homogeneous mixture, as in *Form.* 30, 31, 53, 143.

502. Where we introduce two substances in a prescription, intended to act chemically upon each other, whether to obtain an educt or a product, they should be placed in juxta-position, as in *Form.* 26, 65, 95, 133, 138, 170, 171.

503. In cases where we have to direct compound decoctions or infusions of different articles, a chemical knowledge of the nature of the several ingredients must determine the order of the arrangement. In directing extemporaneous preparations of this kind, it will be a question whether any, and which of the ingredients should be added at the conclusion of, or even subsequent to, the ebullition of the other; for instance, in the preparation of the *Decoct. Sarzæ comp.*, we perceive that the sarsaparilla is first boiled, and the sassafras and other ingredients not added until the ebullition has ceased; and so must cinnamon and other volatile matters be treated under similar circumstances. *Form.* 44, which is recommended by Pringle, as affording a valuable remedy in typhus fever, will furnish a good example for our guidance. The preparation of the ingredients is resolved into three distinct stages, and it is easy to perceive that, by any other arrangement, their several virtues could not be so fully obtained and secured from change. In the first place, the *Cinchona* is made to yield its full powers by decoction, judiciously limited as to the time of its duration; a process which would obviously impair the virtues of *Serpentaria*, connected as they are with a volatile principle; this latter body is therefore not added until the conclusion of the boiling. Equally evident is it that, had the spirit of cinnamon been previously introduced, it would have been volatilised and lost; while the addition of the acid, at any other stage than that directed, might have occasioned injurious changes in the organic principles. On the other hand, in directing a simple infusion of the *Bark* with *Sulphuric Acid*, the acid should be added to the water before it is poured upon the coarse powder, by which the *Quina* or

Cinchonia will be more effectually extracted, in the form of a *Sulphate*, and be moreover protected from the reaction of the *Tannic Acid*, which might otherwise render it insoluble.

504. The doses of medicinal substances are specific with respect to each, and can therefore be only learnt by experience; the practitioner, however, is too often betrayed into the error of supposing that the powers of a remedy always increase "in an equal ratio with its dose, whereas *the dose alone very frequently determines its specific action.* "Medicines," says Linnæus, "differ from poisons, not in their nature, but in their dose," which is but a paraphrase of the well known aphorism of Pliny, "*Ubi virtus, ibi virus*"*—so that food, remedies, and poisons, may be said to branch into each other by indefinable gradations. Five grains of *Camphor* act as a mild sedative and slight diaphoretic, whereas twenty grains produce nausea, and act as a stimulant; so, again, *Opium* in small doses exhilarates, in full ones at once proves sedative, and in a still greater quantity, instead of promoting, prevents sleep, and rather stimulates the bowels than acts as an astringent; so will even *Alum* in large doses prove cathartic, while in smaller ones it will occasion costiveness. It is well known also that the preparations of *Antimony* will either vomit, purge, or sweat, according to the quantity exhibited.

505. It would appear that *powerful doses are disposed to produce local rather than general effects.* Experience seems to prove that, in this respect, the effect of an internal remedy is analogous to that of an external impression; if violent, it affects more particularly the part to which it is directly applied, as pinching does that of the skin; whereas titillation, which may be said to differ from the former only in degree, acts upon the whole system, and if long continued would even occasion convulsions. Upon a similar principle, if a large dose

* The word "*Venenum*" was employed by the ancients to denote both a poison and a medicine. In the former of these acceptations it is frequently used by Virgil, in the latter by Plautus.

of the mercurial pill be given, it will act upon the bowels, and be eliminated from the body, whereas in smaller doses it will affect the system generally, to the most minute ramifications of its capillaries. It is very evident that the regulation of the dose of a medicine is of the highest importance, and deserves more attention than has been usually bestowed upon it. *Substances that are inert and useless in one dose, may, in another, prove active and valuable.* Hence we may discover one of the causes to which mineral waters are indebted for an efficacy which does not distinguish artificial combinations of the same ingredient, united in different quantities; and hence, too, the failure of many *alterative* medicines, from an erroneous adjustment of their doses. We need not seek far for an example of the very different and opposite effects which the same substance can produce in different doses; the operation of common salt is familiar to us all; Sir John Pringle has shown that in quantities, such as we usually take with our food, its action is highly septic, softening and resolving the meat to which it is applied, whereas in larger quantities it actually preserves such substances from change, and therefore when so taken, instead of promoting destroys digestion.

506. It is a great mistake to suppose that a medicine is inefficacious, merely because an obvious effect does not follow each dose of it; on the contrary, it frequently happens that where it occasions an immediate and palpable influence, we actually lose the assistance which the slow and scarcely perceptible exercise of its powers might afford. Dr. Barlow, whose remarks always bear the stamp of sound experience, and will ever command the attention and respect of the physician, observes, " It is very possible that practitioners often err, especially in the treatment of chronic maladies, from requiring an obvious effect from each dose administered; where it is ascertained that a medicine actually possesses inherent powers, the slow and almost imperceptible exercise of these powers should not be despised. There is often more wisdom in seconding the effects of nature than in superseding

them;" (*Cyclopædia of Practical Medicine, Art. Gastrodynia;*) and in his essay on gout (*Ibid*) he says, "Although in active and urgent disease, requiring prompt relief, we would employ the full and adequate agency of remedies, yet in a large portion of medical practice, and especially where long established or habitual morbid actions are to be corrected, we are persuaded that more good results from their more gradual and oftentimes imperceptible operation."

507. In graduating the doses of medicines, there are certain *general* influences which must be appreciated, *e. g.*—(*a*) AGE—(*b*) SEX—(*c*) TEMPERAMENT—(*d*) CONSTITUTIONAL POWER—(*e*) HABIT—(*f*) DIET—(*g*) PROFESSION—(*h*) CLIMATE AND SEASON—(*i*) NATURE AND DURATION OF THE DISEASE—(*k*) TIME OF THE DAY—(*l*) IDIOSYNCRASY—(*m*) INFLUENCE OF IMAGINATION—(*n*) VARIABLE ACTIVITY OF THE MEDICINE.

508. (*a*) AGE.—Too much reliance should not be placed upon any general formula for the graduation of the doses of medicines to the different ages of the patient. The popular scheme of Gaubius is that which has been referred to upon all occasions, and it probably furnishes an approximation as free from objection as any that could be contrived. It is in the form of a table, in which the relative doses are placed opposite to the different ages. Dr. Young, however, has given us the following simple formula, by which we obtain the same results, viz.—

"*For children under twelve years the doses of most medicines must be diminished in the proportion of the age, to the age increased by twelve*,"—*thus*:

At two years to 1-7th, *viz.*

$$\frac{2}{2+12} = \frac{1}{7}$$

At twenty-one the full dose to be given.

To all such general rules, however, there are many exceptions: thus children will bear larger doses of *Calomel* than even adults, and many medicines which do not affect adults, although exhibited in considerable quantities, prove injurious

even in the smallest doses to children; very young infants, for example, are highly susceptible of the powers of opium; three drops of laudanum have proved fatal to a child of fourteen months, and cases constantly occur of mischief produced by the careless use of syrup of poppies.

(*b*) Sex.—It is supposed that women generally require smaller doses, especially with regard to narcotics, than men; but I very much doubt whether any general rule, capable of practical application, can be established upon this point. The susceptibility of the individual to be acted upon is the only circumstance to be taken into account.

(*c*) Temperament.—The elements of Hippocrates gave birth to the first doctrine of temperaments; the term, signifying to *temper*, arose from the belief that certain individual peculiarities depended upon variations in the relative proportions of the animal fluids, and that where they were properly adjusted, they *tempered* each other so as to produce a perfect result, or *temperament*. In cases, however, in which any one of such supposed fluids improperly predominated, as yellow or black bile, blood, or phlegm, it was considered that a corresponding *temperament* was produced, and was accordingly designated by a characteristic name, as the *bilious; atrabilious*, or *melancholic;* the *sanguineous*; and the *phlegmatic*. It is scarcely necessary to observe that modern physiology, although it has discarded the doctrine of humours, has not denied the existence of certain peculiarities affecting individuals; but so many absurd notions have been mixed up with this subject, and such imaginary refinements have been displayed in the attempt to individualise the *temperament*, that it is scarcely possible to approach it with the prospect of deriving from its examination any facts of really practical value. We may, however, admit that certain organs, or their functions, are more energetic in some individuals than in others; thus there exists in some a highly susceptible nervous system, with little muscular power; in others a more than ordinate activity of the vascular system; and in others, again, a more than just

share of muscular developement, with diminished nervous energy; while in many persons we find that all the power and functions of the body are below the healthy standard; hence we may fairly acknowledge the existence of the *nervous sanguine*, *muscular*, and *relaxed* temperament, without the aid of hypothesis; and it is equally certain that upon each of these temperaments medicines will produce very unequal effects. *Opiates* may act in smaller doses with greater effect upon those of the nervous temperament; stimulants upon the sanguineous; and evacuants upon the relaxed.

(*d*) Constitutional Power. In addition to the above remark with respect to the relaxed temperament, let it be remembered that, in apportioning the dose of a very active medicine, it is of great moment to determine the relative degrees of power between the system and the remedy, and to know to what extent the latter is to be carried, consonantly with the powers of life to resist it; thus, after a patient has been exhausted by protracted and severe suffering and watching, a dose different to one at the commencement of the disease will be requisite. The importance of this precept is impressed upon my mind from having witnessed, in the course of practice, several instances of the mischief that has arisen from a want of attention to it. In the application of external remedies to diseased parts, it especially behoves the surgeon to take into consideration the degree of vitality possessed by such parts, and to graduate their strength accordingly. Mr. Henry Earle published a very interesting case in illustration of this principle. The arm of a person became paralytic, in consequence of an injury of the axillary plexus of nerves from a fracture of the collar bone; upon keeping the limb for nearly half an hour in a tub of warm grains, *which were previously ascertained by the other hand not to be too hot*,* the whole hand became blistered in a most alarming manner, and

* "Cases and Observations, illustrating the Influence of the Nervous System in regulating Animal Heat," by H. Earle, Esq.; published in the seventh volume of the Medico-Chirurgical Transactions.

sloughs formed at the extremities of the fingers, and underneath the nails; a considerable degree of inflammation subsequently spread in the course of the absorbents, and matter formed in the axilla which was soon absorbed, and the inflammation assuaged; whence it follows, that a limb deprived of its usual nervous energy cannot sustain, without injury, an elevation of temperature which would not be in the least prejudicial to a healthy member. Mr. Earle supports this conclusion by the relation of another case, in which the ulnar nerve had been divided, for the cure of a painful affection of the arm, the consequence of which operation was, that the patient was incapable of washing in water at a temperature that was quite harmless to every duly vitalized part, without suffering from vesication and sloughs. In cases of diminished sensibility, or coma, *Mustard poultices*, and similar stimulating applications, should be carefully watched, since there will be a risk of inducing gangrene in the part, should its duration be carried beyond the powers of reaction; as long as the patient is capable of feeling the intense pain, we have a criterion by which to judge, but in cases of stupor the greatest circumspection is required; so, again, in the application of ammonia to the nostrils as a restorative in a fainting fit, care should be taken that it be not so constantly applied as to excite tracheal or bronchial irritation, since the patient being insensible to the stimulus, is incapable of affording any indication of its power.

(*e*) Habit.—A stimulus too frequently repeated will diminish the excitability of the organs upon which it acts; hence habit, or the protracted use of a medicine, will generally diminish its power; although there are many exceptions to the rule. Certain saline cathartics, for instance, when long continued, would appear to acquire increased activity, as is exemplified in the familiar operation of the Cheltenham waters. Emetics also frequently become more powerful by repetition: Cullen informs us that he knew a person so accustomed to excite vomiting in himself, that the one-twentieth part of a

grain of tartar emetic was sufficient to produce a convulsive action of the stomach: in some cases such an effect may be referred to the operation of the imagination; for, after the frequent use of an emetic, the mere sight of it, or even conversation relative to it, has been found to occasion nausea. The influence of belladonna in paralysing the iris is not diminished by habit. I have been informed by Mr. Lawrence that he had a patient who used it daily without any interruption, for four years, and it continued throughout to produce the same effect as it did on its first application; and yet, by repeated doses of the same substance internally administered, the system becomes less susceptible of its action. This fact gives support to the observation of Dr. Christison,* that the effect of habit in diminishing the power of *vegetable* poisons is nothing more than an increased power acquired by the stomach of decomposing it, just as it gradually acquires an increased facility in digesting some alimentary substances which are, at first, very indigestible. On the contrary, inorganic substances are little impaired in activity by the force of habit; Dr. Lambe has stated with regard to lead, that "the constitution, so far from being reconciled to it by habit, is rendered more and more sensible to its irritation by continuance." Certain other medicines would also appear to have the property of *accumulating*† in the system; this is evident with regard to *Mercury*, and perhaps to *Arsenic* and several metallic compounds, as those of *Iron*. Dr. Withering has also observed that the repetition of small doses of *Digitalis*, at short intervals, until it produces a sensible effect, is an unsafe practice, since a dangerous accumulation will frequently take place before any signals of forbearance present them-

* Treatise on Poisons.

† By the use of this term, it is only intended to express a certain phenomenon without any regard to its cause. Cumulative action may, on some occasions, depend upon the absolutely increased quantity of the substance in the system, as in the instance of mercury, while in others the phenomenon may arise from an increasing susceptibility of the system to its action.

selves. Iodine, in doses of a quarter of a grain, frequently repeated, will for a time not occasion any obvious effect, when all at once it will operate with poisonous activity. In cases of habituation, which are marked by the increasing tolerance of a medicine, augmentation of dose will not always remedy the evil. Dr. Venables has justly remarked that the susceptibility cannot be kept up by over doses, but that by a temporary suspension of the medicine, it may be restored; thus, when the average extent of dose fails to produce its accustomed effects, the medicine should be laid aside for a time, and after a respite has been thus granted to the system, we shall discover the return of its sensibility, when we may again resort to our means, confident of finding the usual susceptibility to impression. It is upon this principle that I have already advocated the propriety of alternating the use of different stimulants. (400.)

(*f*) Diet.—The state of the digestive process should enter into all our considerations upon this subject; certain substances, if taken into the stomach within a certain period after a meal, will invariably arrest or disturb the digestion. It has been wisely said that medicine, as too commonly administered, interferes with appetite before a meal, and with digestion after it. It would be safe to establish as a general rule, a maxim that no medicine should be given for three hours after dinner, although this rule even may have its exceptions; for instance, where a dose of *Corrosive Sublimate* is found to irritate an empty stomach, it may be administered with propriety an hour after the meal. The same observation will apply to *Iodine;* in both cases, however, a question may arise as to the chemical changes which may be induced upon these bodies by the action of the food.

(*g*) Profession.—The sedentary or active habits which distinguish a trade or profession, must necessarily be taken into account in our adjustment of the strength and dose of a remedy.

(*h*) Climate and Season.—With respect to the influence of

climate upon the medicinal activity of remedies, I have already offered some observations. (p. 120.) As far as it relates to their doses I have only to add, that the British practitioner must not allow his previous experience in tropical climates to induce him to administer such doses of mercury in England, as may have been found salutary in India, or in other colonies of similar temperature. In general, the denizen of the metropolis will not sustain depletion like those who imbibe the pure breezes of the country; this is remarkable with respect to erysipelas, in which venesection may often be salutary in the country, while it will be fatal in London. The cold east winds of spring exert a very depressing influence upon the powers of life; all surgical operations should, if possible, be avoided in such a season; during the prevalence of these winds in February, 1840, *phlebitis* very commonly occurred after venesection.

(*i*) Nature and duration of the disease.—That different diseases very differently influence the susceptibility of the system with regard to medicine, is generally admitted; thus emetics act very readily in febrile affections, while in those of the neuroses they produce their effect with difficulty, a fact which suggests an important precaution in their administration. (199.) Mercury is greatly influenced in its effects by disease; in inflammation of the serous membranes tending to effusion, it affects the mouth very tardily; in continued fever it loses its specific power, especially in those of tropical climates. In typhus, wine and spirit have been administered to a very great extent without any sensible excitement. In dysentery, epidemic cholera, tetanus, and delirium tremens, very large doses of opium may be given without effect, while in other nervous affections a morbid influence will be frequently produced by the smallest quantity. In paralysis the effects of nux vomica, or strychnia, are principally observed in the paralysed parts. The *duration* of the disease, by influencing constitutional power, must, as above stated, be taken into account when we regulate the dose of a powerful medicine.

(*k*) TIME OF THE DAY at which remedies should be administered deserves some attention. *Evacuating medicines* ought to be exhibited late at night, or early in the morning; thus substances of tardy operation, as *Calomel*, and the resinous purgatives, should be given at night, while saline purgatives, senna, castor oil, &c., may be given in the morning. It would seem that during sleep the bowels are not so irritable, and consequently not so easily acted upon, which allows time for the full solution of the substance. The same observation applies to *Alterative* and other medicines that are liable to be counteracted by a vexatious irritability of the bowels; it is on this account eligible to exhibit *Mercurial Pill*, when intended to act upon the system, at bed-time. On the other hand, where the effects of a remedy are likely to be lost by perspiration, as will happen with *Diuretics*, many of which are by external heat changed into *Diaphoretics*, it may be a question whether we cannot select some more favourable period for their exhibition. *Opium* will act differently in the morning and at night; in the former case the exciting effects will be more obvious, in the latter the hypnotic. In fevers it is of importance to consult in all respects the quiet and comfort of the patient; Dr. Hamilton, therefore, in his valuable work on Purgatives, very judiciously observes that, on this account, the exhibition of purgative medicines should be so timed that their effects may be expected during the day. In some cases the time of administration must be regulated by the stage of the disease; thus in fevers, a dose of opium will either increase the heat of the body, augment thirst and restlessness, or occasion tranquillity and sleep, according to the temperature of the system at the time of its administration; for this reason Dr. Currie advises us not to give the evening dose of opium in typhoid fevers till very late, or about one or two in the morning, when the heat is subsiding and the moisture coming on. Emetics administered for the cure of the slighter forms of pyrexia should be given in the evening, as their operation leaves a tendency to sleep and diaphoresis, which it

is useful to promote. Diaphoretics should be always given after the digestive process is ended, for during the performance of this function the emunctories of the skin are less disposed to action. *Antacids* should not be given shortly before meals, (225,) and in giving alkalies, as antilithics, we must remember that the urine is most acid after the principal meal, and consequently we should contrive to exhibit the remedy three hours after it. Remedies that require to be quickly *absorbed* will probably be more efficient in the morning after sleep; the old custom of giving medicines in a morning, *fasting*, is not quite so absurd as some modern practitioners have been led to suppose; the copious potations of mineral waters so commonly taken by invalids in the morning could not be so readily disposed of at any other period of the day, when the absorbents are less active.

(*l*) Idiosyncrasy.—Constitutional peculiarities will sometimes render the operation of the mildest medicine poisonous. "*Virum novi*," says Gaubius, "*qui cum fatuum lapidum cancrorum pulvisculum ingessit, vix mitius afficitur quam alii ab arsenico.*" I have seen a general erysipelas follow the application of a blister, and tormina of the bowels, scarcely less severe than those from some corrosive poison, attend the operation of purgatives containing senna! In some constitutions antimony has produced ptyalism; Dr. James assured Sir George Baker that he had known six instances of it, although the patient thus affected had neither their teeth loosened, nor their breath rendered offensive; Dr. Griffith, an American physician, published a case in which tartar-emetic ointment caused salivation, and Dr. Jackson, of the same country, has met with similar instances. The peculiar susceptibility in certain individuals of the effects of particular plants is also very extraordinary. Murray relates that unpleasant symptoms have been experienced by persons having merely kept *Aconite* for some time in the hand or on the bosom. I am acquainted with two medical men, in whom the odour of ipecacuan always produces a most distressing dyspnœa; Mr.

Chevalier has informed us that he once knew a lady who could never take *powdered* rhubarb, without an erysipelatous efflorescence almost immediately showing itself, and yet she could take it in the form of *infusion* with perfect impunity. There are some idiosyncrasies so incredible, that nothing short of the most unimpeachable testimony could sanction our belief in their existence. Schenkius relates a case in which the general law of astringents and cathartics was always reversed. Donatus tells us of a boy whose jaws swelled, whose face broke out in spots, and whose lips frothed whenever he ate an egg. Dr. Prout relates the case of a person who could not eat mutton without exhibiting all the symptoms of poisoning. The late Pope Pius VII. had such an antipathy to musk, that on one occasion of presentation, an individual of the company having been scented with that perfume, his holiness was obliged immediately to dismiss the party.* I have seen, says Montague, some run away at the smell of an apple, as if a musket had been presented at them. Many of those anomalies which we might term idiosyncrasies, occur in different countries, as the consequences of early habits, and are curious, as they show how our natural tastes may be changed by education; what shall we say of the refinement of the ancients, who regarded the flavour of the citron with disgust, while the odour of putrid fish was deemed by them so exquisite that they carried it about in caskets of onyx as a favourite perfume. Custom makes the Greenlander relish his train oil. The wandering hordes of gipsies, and the inhabitants of various savage countries, and especially those about the mouth of the Orange river in Africa, seem to regard fetor as a perfume, and value their food in proportion as it approaches putrefaction; and Dr. Heberden† tells us that there is a town in North America where the spring water is brackish, and that when the inhabitants visit any other province, they

* *Diary of an Invalid.*

† Medical Transactions. Vol. i. p. 5.

choose to put salt into tea or punch, in order, as they say, "to make it taste as it should."

(*m*) THE VARIABLE ACTIVITY OF THE MEDICINE.—It ought to be generally known that the powders of active vegetables, such as *Digitalis*, are liable to lose their virtues unless very carefully preserved from light and air; and that certain liquids undergo changes no less injurious. The general practitioner who dispenses his own medicines would perhaps act cautiously if he were to reduce the dose, should it be a very considerable one, whenever a fresh parcel is commenced. The physician cannot resort to such an expedient, but he ought to prescribe such remedies, if liquid, in the form of draughts to be daily renewed; this remark particularly applies to *Hydrocyanic* acid; the observations of Mr. Jacob Bell upon this point are well worthy of attention, as his great practical experience guarantees their truth. "Every time the stopper is removed from a bottle containing it, a portion of the real acid escapes, and although the quantity which is liberated at each time may be inappreciable, it is clear that when a bottle, containing an ounce or two, is nearly emptied in the usual routine of dispensing, the remaining portion must be considerably reduced in strength. This may serve to explain a circumstance which has occasionally excited the surprise of medical men, that after having daily increased the dose, with careful attention to the effects, up to a certain point, a very slight accession, or even a repetition of the last dose, has been known to produce violent and alarming symptoms. It has, in several instances, been discovered on investigation, that the last mixture was prepared from a fresh bottle of acid, which had not lost strength by exposure." (*Pharm. Trans.* No. III.)

509. The intervals between each DOSE must be regulated according to certain circumstances, which it will be necessary to observe. We are, in the first place, to consider whether it be desirable or not, that the latter dose should support the effects of the preceding one, or whether there be any fear of a reaction or collapse taking place after the effect of one dose

has subsided, unless immediately repeated; thus the effects of diffusible stimulants, such as ammonia and æther, are very evanescent, they should therefore be repeated at short intervals; the same may probably be the case with *Diaphoretics*, especially the lenient ones; we ought not to allow the period between the doses to be so remote as to occasion any striking abatement in the impression; so again, opium, where its primary and stimulant operation is required, as in gangrene, or fevers of the typhoid type, or any other diseases of debility, should be given in small doses at short intervals, in order that it may enkindle and sustain an uniform and regular state of excitement; but where the object is to mitigate pain, allay irritability, and produce sleep, it ought to be exhibited in full doses, at distant intervals. This question also embraces another consideration of some importance with respect to the energy of the medicine; when violent in its operation, it may be advisable to administer it in a small dose, and to repeat it after a short interval, rather than to give it at once in a full dose. By a similar management we may often enable the stomach to tolerate a medicine which, under other treatment, might be rejected, as I have before explained. (436.)

510. It is also a question of some importance to determine how long a remedy should be continued, with a view to obtain its full benefit. In speaking of the *Confectio Piperis Nigri*, Sir B. Brodie observes, "It is of no use to take it for a week, or a fortnight, it must be persevered in for a month or longer." Sarsaparilla, again, should be given for some time before its advantages can be fairly obtained. On the other hand, there are medicines which may be too long continued; I have already stated (79) that tonics, if administered beyond a certain period, actually increase the evils they are intended to counteract. In the management of *Antilithics*, the greatest vigilance is necessary, in order to prevent their becoming sources of mischief, by inducing morbid tendencies as injurious as those they were designed to correct. (328.)

511. In conclusion, it may be observed, that the physician

who has diligently studied the science of medicinal combination, will find himself, with comparatively a limited experience, fully competent to render his knowledge practically available, while the mere routine practitioner, with his cumbrous bundle of approved recipes, will, after the practice of half a century, still continue unable to deviate from the beaten track without distrust, or to write an original prescription without embarrassment. The scientific prescriber is upon principle acquainted with the *modus operandi* of each ingredient in his formula, and he can change or modify any part of it, according to the effects it may produce, or the object he may wish to accomplish; whereas the servile copyist knows only the general effects attributed to the compound, and should it disappoint his expectations, his only resource is to recur to his bundle, and to seek from amidst its stores for some other formula that may, perchance, better suit his purpose; for he is as incapable of correcting the errors, as he is of extending or modifying the powers of a prescription.

512. In writing a prescription, it should be a prime object of the practitioner to render it perfectly intelligible to those who are to dispense it. The compounder of drugs cannot be expected to solve riddles, *Davus est non Œdipus.* The writing ought therefore to be fairly legible, without interlineations or erasures; and all terms capable of misconstruction, or abbreviations not recognised by custom, should be carefully avoided. The practitioner will doubtless often find it convenient to drop a termination, and for reasons to which Cicero* even has given his sanction; but if the custom be abused, and carried beyond the indulgence conventionally conceded, it may lead to most serious mistakes.† In our state of transition from the

* When Pompey was about to consecrate the temple of Victory, a difficulty arose as to the manner in which he should express his third consulship, whether it should be Consul *Tertio,* or Consul *Tertium?* The learned men of Rome were divided in opinion, and even Cicero left the question undecided, for in order to satisfy all parties, he directed it should be abbreviated as Consul *Tert.*

† I will here relate two instances to show the mischief that may occur

former to the present pharmacopœia, the practitioner has occasionally fallen into the error of employing the nomenclature of both in the same prescription; indiscriminately mixing up that of 1824 with that of 1836. If he thinks proper to adhere to the term *Hydrargyri Submurias*, all the names associated with it ought to be contemporary; in which case his language, to whichever standard it might refer, would, at least, be consistent and intelligible. I have been informed by dispensing chemists that a departure from this rule has been attended with considerable embarrassment, and might lead to serious mistakes. Suppose the leading article was directed in the nomenclature of 1824, the dispenser would fairly infer that all the other ingredients referred to that of the same date; if, for example, to "*Decoct. Sarsaparillæ*," (instead of *Decoct. Sarzæ*,) the Sodæ Carbonas was directed to be added, would he not be justified in supposing the present *Sesquicarbonate* (the *Sodæ Carbonas* of 1824) was intended? whereas the prescriber might have really meant to order the

from a slovenly mode of writing a prescription. One of our eminent surgeons having occasion to direct the application of a lead plaster, (*Emplast. Litharg.* P. L. 1787,) he abbreviated the term as follows, substituting at the same time the letter *y* for that of *i*, *Emp. Lyth.*, when the compounder, reading the *h* for the *t*, sent the *Emplast. Lyttæ!* as it was applied to the groin, it is scarcely necessary to state the distress of the patient, and the dismissal of the practitioner. A somewhat similar, although still more alarming mistake occurred a few months ago, within my own knowledge. I had been sent for to see a child with hooping-cough; on entering the apartment I found its mother in considerable pain in her hand and arm. A medical man had just before prescribed for the child, and his prescription was sent to a neighbouring chemist; the bottle arrived, when the mother, on taking it into her hand, in order to administer it according to the directions given, was surprised by the expulsion of the cork, and the contents of the phial flying out over her hand and arm. On seeing the prescription, and the effect it had produced, I at once perceived the nature of the mistake. The prescription is now before me, and I will copy it *literatim*. ℞ *Syr. Papav. alb.* ʒij—*Aquæ fontis* ʒvj, ft. mistura ut dict. sumend. The downstroke of the *n* might certainly have been mistaken for *r*, but this was no excuse for the chemist, who ought to have known that the prescriber never could have meant to give the child *Aqua Fortis*.

carbonate of the present, which is identified with the *Sub*-carbonate of the former pharmacopœia; but a much more serious error might be committed, did any such confusion arise as to the *Infusion of Digitalis*, the late preparation having been more than double the strength of that recently introduced, without any corresponding change having been made in its name.

513. In writing a prescription, the young practitioner will experience an advantage in first arranging its several ingredients in proper order, and afterwards in placing the dose opposite to each of them: by which means he will be better able to comprehend the relations of the different elements to each other, and to adjust their proportions with greater satisfaction.

514. Let not the practitioner imagine that the signature affixed to his prescription is the last act by which he is absolved from further responsibility; the duties of his visit are still far from being complete. He has next to direct his attention to various circumstances, by which the success of his remedies may be thwarted, or promoted; and he has to issue his mandates accordingly. The position of the patient,* his clothing, the temperature and ventilation of the apartment, the degree of light to be admitted, and the diet to be allowed, are each worthy of his serious consideration. In cases of fever, the morbid excitement is always exasperated by every kind of bodily exertion; the erect posture even is badly borne by such patients; with regard to diet, Nature very kindly interposes her authority, by not only removing all desire for food, but by creating a positive aversion to it, she protects the patient from the natural, though injudicious, importunity of friends. With respect to temperature and ventilation, to

* There is a precaution with regard to the act of vomiting, which ought to have been stated under the history of emetics—to be careful how we excite it in bedridden persons, who are incapable of being raised from the horizontal position. Cases have occurred in which suffocation has happened under such circumstances.

quote the words of Dr. Barlow, " The time is happily gone by when febrile patients were immured in heated chambers, overwhelmed with blankets, a good fire maintained to prevent the risk of cold, and every aperture through which pure air could enter, even to the keyhole of the door, carefully closed. The febrile sufferer is now allowed to breathe a pure atmosphere; and the intelligent practitioner, to whom the elements of physics should be familiar, can be at no loss to ascertain whether the circumstances of the chamber be such as to afford the necessary assurance of adequate ventilation. The confinement of air by closed bedcurtains is particularly pernicious, and should be utterly disallowed, the use of those being limited to averting direct currents, and moderating the glare of light; but light even should not be wholly excluded from the sick chamber, except in cases of high cerebral excitement, or morbid sensibility of vision." (*Cyclop. of Pract. Med.*, vol. i. p. 101.)

515. As to the details of regimen, it cannot be supposed that I can enter upon the subject further than to offer a general precaution relating to the operation of the medicines prescribed; not heedlessly to countenance the use of such food as we may suppose to be capable of decomposing the remedy. No scientific physician would administer *Iodine* in arrowroot, or allow that substance to be taken immediately after it, unless his object were to diminish its action; in like manner, we should not allow alum whey to be drank after a dose of the *Acetate of Lead* in hemoptysis; and it is questionable whether strong black or green tea, on account of its *tannic* acid, should be given after a dose of antimony. And so with regard to other medicinal substances, a knowledge of their composition can alone guide us in such particulars; the subject deserves attention, and errors committed from a disregard of it, are probably more influential than is generally believed.

THE CHEMICAL AND PHARMACEUTICAL ERRORS WHICH MAY BE COMMITTED IN THE COMPOSITION OF EXTEMPORANEOUS FORMULÆ ARE REFERRIBLE TO THE FOLLOWING SOURCES.

1. *The methods directed for the preparation of the ingredients, are either inadequate to the accomplishment of the object, or they change and destroy the efficacy of the substances.*

516. We have only to examine the dispensatories of different periods, and to observe the various rude and unmeaning processes to which medicinal bodies have been subjected, with the intention of extracting their virtues, or of rendering them available as remedies, in order to understand how greatly the medical art has been indebted to the modern discoveries of chemistry, for the refinement of all pharmaceutical operations, as well as for the more scientific forms in which medicines are now administered. Until the nature of those active principles which enter into the composition of organic compounds was sufficiently known, it was very natural, and not unwise, for the physician to direct the administration of all such substances in the crude mass, for how could he discriminate between their inert and active ingredients; and hence the older dispensatories abound in electuaries, confections, and powders; in the progress, however, of knowledge, it was soon discovered that certain principles existed in vegetable bodies which were wholly unconnected with their active properties, and various processes of separation were accordingly proposed, which in their commencement were necessarily rude and imperfect, and not unfrequently the suggestions of false theory; they have, however, gradually assumed a more scientific character, and in the present day they must be considered as having attained a degree of refinement consistent with the

advanced state of chemical science, and to have become so identified with its principles, as to render their further improvement progressive with it. This extended knowledge has not only improved our preparations, but it has pointed out the different sources of error to which the operator, as well as the prescriber, may be exposed; and although the minute consideration of the subject may be regarded as more important to the former than to the latter, still there are points in the inquiry with which the practical physician is bound to be acquainted. He may, for instance, be called upon to decide between the eligibility of an infusion and decoction of a vegetable not to be found in the pharmacopœia; and he will have to determine, according to the chemical nature of the substance, and the mutual reaction of its elements, the manner in which such operations should be conducted. He would commit a great error were he to direct the *decoction* of herbs whose virtues resided in essential oils, or volatile principles. In addition to the remarks already offered on this subject, (503,) I may observe that although the distilled water of laurel and bitter almond be eminently poisonous, the watery extracts of these plants, prepared by decoction, are perfectly inert; and Orfila found that an extract of hemlock, obtained by boiling the dried powder in water, and evaporating the decoction, was entirely destitute of activity. It has been already stated that the onion tribe, by such treatment, lose all their stimulating properties. We are also to remember that many very important chemical changes are induced amongst the vegetable principles themselves during the act of ebullition; the extractive matter frequently becomes oxidized, loses its solubility, and passes into a state of resin. The protracted boiling of *Bark* has been repeatedly brought forward as affording a striking instance of internal changes induced in a vegetable substance by the reciprocal action of its elements upon each other, although their precise nature is still involved in some doubt. It was formerly supposed that the *extractive* matter became insoluble by oxidation; Dr. Christison, however,

suggests that the *Quina* and *Cinchonia* combine with the red colouring principle, and form compounds sparingly soluble at 212°, and almost insoluble at 60°; while Mr. Donovan considers the *Tannic Acid* as the precipitant, forming insoluble *Tannates of Quina and Cinchonia.* Again, Dr. Christison observes that in the case of *Senega root*, a decoction cannot be made, without the active principle (*Senegin*) forming an insoluble compound with the colouring matter and albumen of the root; the Edinburgh College has accordingly abandoned the decoction in favour of the infusion of that root. Where starch forms a principal constituent, it will be a question whether infusion or decoction shall be selected; if our object be to retain its presence, the latter must be adopted; if to reject it, the former is to be preferred.* Infusion will not extract principles that are connected with resino-mucilaginous matter. In making infusions, boiling water is generally employed, and is without doubt often indispensable,† but in many cases advantage would be derived from employing it cold;‡ especially as the operation may now be performed in the way of *Percolation*, or displacement, as recently introduced into the Edinburgh Pharmacopœia for the preparation of tinctures, and described by Dr. Christison in his Dispensatory.

517. Solid substances are also liable to be changed by the undue application of heat; in certain cases it has been usual to expose a body to heat, previous to its reduction to powder,

* This fact is well known to brewers, who are extremely cautious not to use their water too hot.

† Although we may not be able to give a chemical explanation of the fact, we all know that, unless boiling water be used, we cannot satisfactorily obtain the virtues of tea. The monks of St. Bernard complain that they cannot make good bouillie; the case is simply this, that from the altitude of their monastery the water boils before it can arrive at a sufficiently high temperature. I am not aware whether travellers have ever observed the same circumstance with regard to tea.

‡ Mr. Jacob Bell states that it has been discovered by experiment, that rhubarb and senna treated with cold water, will yield larger proportions of extract, and more efficacious products, than when heat is applied. *Pharm. Trans.* No. II.

but the doubtful influence of an exalted temperature ought to dispose us to question the practice; as an example, the astringency of the stalks of the artichoke is so entirely destroyed by being gently heated in an oven, that they will no longer strike a black with the salts of iron; starch, as is well known, by the action of heat is changed into a species of gum, ("*British Gum,*") and ceases to be acted upon by iodine. It has been already mentioned (475) that the coffee-bean thus undergoes an equally important change. Its infusion strikes black with sulphate of iron, but does not precipitate with gelatin, whereas, after having been roasted, a portion of tannic acid is produced, and a new aromatic principle is developed.

518. An instance of the baneful effects which may arise from an erroneous method of preparation happened some years ago to fall under my immediate notice and care; it was in preparing an infusion of the *Veratrum* with *Opium*, as directed by Mr. Moore, when the dispenser substituted a spirituous for a vinous menstruum. In prescribing a saline draught, with the addition of antimonial wine, if the alkali should happen to predominate, the *Potassio-tartrate* will be decomposed.

519. The very common error may be here noticed of prescribing a substance in such a form as not to be acted upon with any effect by the solvent; as an example, it may be stated that, in preparing an infusion of *Juniper Berries*, unless pains be taken to break the seed, it will contain but little power as a medicine.

II. *Substances are added together which are incapable of mixing, or of forming compounds of uniform and suitable consistence.*

520. This may be termed an error in the *Mechanism* of the prescription, and has been generally regarded as more incon-

venient than dangerous, more fatal to the credit of the practitioner than to the case of the patient. The observations, however, which are offered in this work must satisfy the practitioner that such errors are more mischievous in their effects than has been generally supposed; they are so palpable and self-evident in their nature, that it will not be necessary to offer more than a few illustrative examples; thus, *Calomel* has been ordered to be given in an aqueous vehicle, and certain resinous tinctures have been directed in draughts without the necessary intervention of mucilage, while powders have been introduced in such proportions as to render the liquid too thick to be even poured out of the phial. On the contrary, an intermixture of solid substances has been formally prescribed in the form of powder, that possessed the perverse property of becoming liquid by triture; an instance of this kind occurred within my own knowledge; it was a prescription for the relief of cardialgia and constipation, and the patient was advised to supply himself with a liberal store of the remedy to be taken with him into the country. The formula consisted of a mixture of *Sulphate of Soda* and *Carbonate of Potass*, but the "*Fiat Pulvis*" of the physician only served to excite the ridicule of the dispensing chemist, who soon discovered that the ingredients dissolved into a liquid by being triturated in his mortar. Again, substances have been made into pills, whose consistence rendered it impossible that they should preserve the globular form; Dr. Percival, in his Essays, very ingenuously exemplifies this error by stating a case which occurred in his own practice. "I ordered," says he, "a combination of *Camphor* and *Balsam of Copaiba*, in the form of pills; but the apothecary informed me that he was unable to form them into a mass, since they liquefied like treacle." I may observe, that the addition of a small portion of the coagulated yolk of egg would have rendered the mass manageable. In other instances, the pills, in consequence of ill-assorted ingredients, have become so hard that they might have been fired through a deal board. The editor of the

British and Foreign Review has related an amusing anecdote of this kind. He says he once knew an instance in which refractory pills of this nature, on being taken by an old gentleman, led to the curious mistake of his having been pronounced by an apothecary to be labouring under gall-stones. "We found," says he, "the supposed calculi carefully preserved, literally in boxfuls, and we believe in the very box from which they had been originally taken;" thus had they performed their appointed route without having suffered any waste of substance. I have a somewhat similar story to relate, but one not quite so free from mischance; and I introduce it for the purpose of correcting any impression which may exist as to the harmless nature of such insoluble bodies. The case to which I allude was that of a lady who had been in the constant habit of taking pills purchased at a patent medicine warehouse. She was seized with the most violent tormina in the intestines, recurring at intervals; and notwithstanding repeated doses of castor oil, and other aperient medicines had been given, a free discharge from the bowels could not be produced, nor any relief obtained; at length, however, by the aid of calomel, and a combination of purgatives, several masses resembling bunches of currants were passed, which were ascertained to be agglutinated pills, and the patient was accordingly relieved from the painful obstruction.

521. Another error consists in directing active substances to be so mixed with, or suspended by confections, as to require a filtration, which will remove the efficient principles from the mixture; or in adding together liquids of such different specific gravities, that on standing they will separate into distinct strata; this would happen were a greater proportion of ether added than an aqueous vehicle could dissolve, the consequence of which might, to say the least of it, be the source of great distress to the patient; but a case might be readily imagined in which such an error would be fatal: suppose to a mixture, holding in solution a given quantity of *Corrosive Sublimate*, an excessive portion of ether were added,

the whole of the mercurial salt would be thus abstracted from the water, and held in solution by the ether, which, by occupying the upper part of the bottle, might be taken in a dose that would be destructive.

III. *Substances are added together which mutually decompose each other; whence the original virtues of one or more of the active ingredients are changed, or altogether lost.*

522. This is a frequent and most serious source of error. If it be admitted that judicious and scientific combination, under the guidance of an enlightened chemistry, has wonderfully extended our resources, so must it be confessed that the abuse of these means has too often transformed our most valuable medicines into inert or feeble compounds; while upon other occasions it has converted the mildest substances into instruments of torture, if not of death. In a lecture delivered before the Society of Apothecaries, Professor Brande stated that he had seen a prescription, in which a mercurial preparation had been ordered in conjunction with nitric acid, and that the patient was brought to "death's door" by the formation of *Nitrate of Mercury* in his stomach. I have myself seen a formula for a preparation which was supposed to resemble the "*Black Drop*." It directed a tincture of opium to be prepared with *rectified* spirit, and mixed with undiluted nitric acid! In this case it may very safely be inferred that its author was not only ignorant of the chemical habitudes of these bodies, but that he was moreover guiltless of ever having perpetrated the act in question, or he would undoubtedly have found that, in consequence of the mutual action of these ingredients, *Hyponitrous Ether* is rapidly produced; and it is probable that the phial and its corrosive contents would have exploded, to the imminent hazard of the operator's eyes. It may perhaps be said that these are extreme cases, to avoid which a very moderate share of chemical information will be

sufficient; granted, but let it be known that there are others which, although not of so dramatic a character, are not the less fatal to the medicinal efficacy of the substances thus incongruously brought together; the file of every apothecary and dispensing chemist would furnish a volume of instances, where the ingredients of the prescription are fighting together in the dark, or at least so adverse to each other as to constitute a most incongruous and chaotic mass.

> "Obstabat aliis aliud, quia corpore, in uno
> Frigida pugnabant calidis, humentia siccis,
> Mollia cum duris, sine pondere habentia pondus."

523. From a choice collection in my possession, I might amuse the reader by the introduction of some strangely misshapen and abortive productions, in which it is not possible to believe that their authors could have had the most remote idea of what they were prescribing. The writer of the following, it may be presumed, had not a very lucid conception of its nature—*Ecce!*

℞. Mist. Camphoræ,
Infus. Rosæ comp. aa ℥iiss.
Spir. Ammoniæ aromat. ʒiij.
Magnesiæ Sulphatis ℥j.
Syrup. ʒiv.
Mist. Sumat Cochl. iij bis quotidie.

I have given it *verbatim* as it was placed in my hands by the patient, with the remark that "it had made her very sick from its nauseous taste and horrid appearance." I was curious to see what such an incongruous mixture would look like, and I therefore ordered it to be "*made up*," as it is called; and had I not known its composition, I should certainly have pronounced it as a specimen from one of the nastiest puddles in London. I have also a formula for an astringent, at the service of any collector of medical curiosities, directing a mixture of *Alum*, and *Chalk* in the form of powder, to be taken in a glass of water; a very moderate share of

chemical knowledge would have informed the practitioner that he was directing a dose of *Plaster of Paris.*

524. To the inexperienced practitioner a more interesting, and yet embarrassing, subject than that of CHEMICAL INCOMPATIBILITY, can scarcely present itself. From our imperfect knowledge of the changes produced in the stomach and system upon our medicines, as well as from certain difficult and obscure questions involved in the consideration of many complex bodies, especially those of organic origin, we are frequently at a loss to determine the exact nature of the substances which are brought into play; and hence have arisen those fallacies which would, *prima facie*, appear to array chemical theory in open hostility to medical experience. It is not surprising therefore, that there should have existed two very different classes of practitioners; the one boldly abjuring every formula which bears an unchemical aspect, the other indiscriminately disregarding in his prescriptions all those scientific precepts which he had been taught in the school of experiment to observe and respect; the one obviously abridges his resources, the other must in many cases render them powerless. It is quite true that our propositions have been often overturned by experience; but are we on that account to join with the ignorant in a crusade against science? Let us rather carefully and candidly investigate the nature of such failures, and we shall not only detect the sources of error, but render them subservient to the advancement of truth; so just is the observation of Morveau that, "*We never profit more than by those unexpected results of experiment, which contradict our analogies and preconceived theories.*"

525. It will not be difficult to bring these two conflicting classes to terms, for it fortunately happens that the arguments which are ready to vindicate the necessity of chemical knowledge, in the construction of our prescriptions, may with equal success be adduced to reconcile many of those very discrepancies, from which has arisen a scepticism with regard to its just value; and it may be here remarked, that not only in

medicine, but in all the useful arts of life, practices or processes which have been found by mature experience to be beneficial, although they may have been empirically proposed, or accidentally adopted, must sooner or later receive the sanction and homage of science. How happily has this been exemplified by the recent discoveries of Liebig* in organic chemistry; for many of the rude practices of the farmer, hitherto regarded, to say the least of them, as unmeaning and useless, have been actually shown by this distinguished author to coincide with the most refined views of chemical philosophy; it is obvious, then, that instances of lucky accident, or of success ultimately attained by persevering trials, so far from disparaging science, or from shaking our confidence in its necessity, will be found, if the subject be fairly worked out, to furnish the most powerful arguments in favour of its paramount importance; for in no case has science explained and sanctioned a practice, which was originally blind or fortuitous, without at the same time suggesting means for its further improvement, or pointing out sources of failure, and interferences which might counteract its value. For example, it is not probable that the physician who first proposed the composition of the "*Mistura Ferri Composita*," was directed by any correct views as to its chemical nature, and we may venture to say that hundreds have prescribed it without the most remote conception of the causes of its excellence; indeed, how often has it been extolled for its medicinal efficacy, in the same breath that it has been condemned for its chemical inconsistency? It was the very stalking-horse of the anti-chemical practitioner, until science stepped in, and not only pointed out its true composition, and the changes which its several ingredients undergo on intermixture, but warned us of the circumstances by which its virtues might be deteriorated or destroyed. No one now doubts that to the decompositions and combinations which take place in the preparation of the *Compound Steel Mixture* it is entirely indebted for its excel-

* "Organic Chemistry in its Applications to Agriculture," &c.

lence; thus the *Sulphate of Iron* and the *Carbonate of Potass* are mutually decomposed, giving rise to *Protocarbonate of Iron*, and *Sulphate of Potass;* the metal thus combined with carbonic acid, being at its minimum of oxidation, is more active than the common *Carbonate*,* (*Sesquioxide*,) and less likely to disturb the stomach than the *Sulphate*. This product, by means of the saponaceous compound simultaneously formed by the union of the *Myrrh* with the excess of alkali, is partly diffused and suspended, and partly dissolved in the mixture, while the resulting *Sulphate of Potass* serves to moderate the too astringent influence which the iron is liable to exert upon the bowels. The *Sugar*, which was originally introduced with no other view than that of imparting sweetness, now actually turns out, for the reason already explained, (491,) to act the important part of protecting (to a certain degree) the iron from further oxidation. By a knowledge then, of the distinct action of each ingredient thus afforded, we at once perceive the nature and extent of the precautions to be observed for securing the due efficacy of this mixture. A strict attention to the relative proportions of its several ingredients is evidently essential; and it is equally obvious that they should be extemporaneously mixed, since, by the contact of the air, the *Protocarbonate* readily exchanges its carbonic acid for oxygen, and passes into a state of an insoluble *Sesquioxide of Iron;* and hence the characteristic green colour of the recent mixture is exchanged for that of reddish-yellow. The knowledge thus acquired has been analogically extended to other preparations of iron, and has shown the importance of securing from change all such as contain the metal in a low state of oxidation; at the same time it has suggested new forms (474) and new combinations, not the

* The Ferri *Carbonas* of P. L. 1809. The Ferri *Subcarbonas* of 1824. It is now properly designated as a *Sesquioxide*. There is no carbonate of the sesquioxide, the oxygen which the carbonate acquires by exposure to the air displaces the carbonic acid.

least important of which is the *Saccharated* carbonate already described. (491.)

526. Like the steel mixture, the compound decoction of aloes (*Baume de vie de Lelièvre*) was most probably in its origin wholly empirical; its value, however, is capable of chemical explanation; the *Aloesin*, by the action of the *Carbonate of Potass*, is rendered more soluble; the powdered *Myrrh* and *Extract of Liquorice* suspend the portion not dissolved, and at the same time disguise its bitterness, while the former of these ingredients is not without its value as a congenial stomachic; the *Saffron* imparts an aromatic flavour, while the *Compound Tincture of Cardamoms* not only renders it more grateful to the stomach, but prevents any spontaneous decomposition. Ample experience has taught me that the pharmacopœia does not contain a more useful compound, in certain forms of dyspepsia, and it is capable of being variously modified by extemporaneous additions.

527. While we are thus bound to acknowledge the importance of chemical knowledge in directing our prescriptions, it is equally our duty to protest against the practice of at once deciding upon the pretensions of every medicinal compound to our confidence by an appeal to the laboratory, and of rejecting as necessarily fallacious all medical testimony which may appear to be inconsistent with the chemical verdict,—"*Successus sæpe ex iis quæ minima credas pendet, et præparationes quæ præter rationem esse, atque ad artis regulas offendere videantur, momentum quandoque ad efficientiam remedii afferre possunt.*" (*Gaubius.*) Whenever a medicine has been found by sound experience to be efficacious, we should listen with great circumspection to any chemical advice for its improvement; from a mistake of this kind the *Compound Extract of Colocynth* was in a former Pharmacopœia deprived of its soap, by which its solubility, and consequently its activity, were greatly diminished. And this was done, as it was said, in order to render it chemically compatible with calomel; the

fact, however, is that this mercurial compound is not in the least acted upon by soap, since the alkaline base of the latter body does not quit its union with the oily acids to enter into combination with the chlorine of the calomel, although I believe a different opinion is still occasionally entertained.

528. In the present day the views of the well-educated physician are less partial and prejudiced; he acknowledges chemistry as the handmaid, but denies her right to dictate as the mistress of physic; he justly appreciates the asserted efficacy of medicinal combinations, as inferred from careful and reiterated experience, at the same time that he cautiously examines, in accordance with the soundest views of chemistry, the induced changes of composition consequent upon intermixture; and he compares, in order that he may reconcile the testimony derived from such different sources. Were we to enter into the history of such inquiries, we should find that simple experience has often suggested distinctions and differences which chemistry, thus directed, has subsequently confirmed and explained. Several years since, the late Mr. Rose transmitted to me a formula for the preparation of what he termed his "*Alterative Drops*," and which he assured me, from very ample experience of its effects, possessed considerable power as a mercurial, and would excite ptyalism with a quickness and certainty which characterised but few preparations of that metal. The principal ingredients were an alcoholic solution of *Corrosive Sublimate*, and a vinous solution of *Emetic Tartar*. It is scarcely necessary to observe, that upon admixture a mutual decomposition must take place; but in stating the nature of the resulting compounds, in the former editions of this work, I have been in error. I supposed that the *Peroxide of Mercury* was thrown down by the alkaline element of the antimonial compound, and that this latter salt, having the balance of its affinities thus overthrown, parted with its *Sesquioxide of Antimony;* I therefore imagined that the mixture was indebted for its activity to the *Peroxide of Mercury*, thus diffused in a state of very minute division,

aided by the *Antimonial Oxide*, which upon principles already discussed, (406,) might be supposed to render the stomach and system more susceptible of its influence. I have, however, lately been led to question the truth of this chemical theory, and I therefore requested Mr. Richard Phillips to institute an experiment, by which a very unexpected result has been obtained; it appears that upon mixing the above solutions, the products of their mutual decomposition are *Calomel*, in a state of minute division,* and *Chloride of Antimony*, with *Tartrate of Potass.*

529. It has been a popular argument against the utility of chemical knowledge, in directing the combinations of our remedies, or rather let me call it a specious sophism in defence of ignorance, that however accurately we may be made acquainted with the composition of a medicine, we can never predict the changes it will undergo in the stomach and system; much obscurity necessarily hangs over this subject, although, from the observations scattered through the preceding pages, the reader may be led to believe that it is not so far beyond the reach of inquiry as some have supposed. Be this as it may, we are surely bound to know what we actually give to our patients; it can never be a matter of indifference what we pour into the cup, because we cannot exactly tell how it may be changed in the stomach.

530. In most of our modern works on the Materia Medica, the substances supposed to be incompatible with each particular article are enumerated under its history; but the reader is left completely in the dark as to the nature of the presumed incompatibility. With a view to supply so important a defect, I have constructed a series of tables, each of which consists of three columns. In the first are enumerated the principal articles of the Pharmacopœia; in the second, the

* Had I discovered this fact before the chapter on Antidotes had been printed, I should have suggested the propriety of employing *Tartar Emetic* for the purpose of ejecting corrosive sublimate from the stomach, and of following up its exhibition in diluent drinks.

substances usually, but often erroneously, considered as being incompatible with each of them; and in the third, the results or products which have been experimentally determined to arise from their intermixture. Before, however, entering upon this subject, it is essential that we should at once come to a perfect understanding as to the precise idea implied by the term *Incompatibility;* the reader, therefore, is informed that, upon the present occasion, it is merely employed to designate some change which takes place in the chemical constitution of one or more bodies, whenever they are brought together under circumstances favourable to their mutual action; but he is not to infer that their medicinal virtues are thereby, of necessity, simultaneously destroyed; for a substance may be chemically incompatible, and yet medicinally consistent with any other given article; and the converse of this proposition may be equally true. Authors who have indiscriminately denounced all bodies, between which decompositions take place, as inadmissible in the same prescription, have taken a very partial and imperfect view of the subject; it has been repeatedly shown that to such decompositions we are indebted for some of our most valuable remedies; we have now, however, only to consider how far such changes of composition may injure or destroy the virtues of certain bodies exposed to them; a question which involves three distinct propositions, *viz.*—1. Whether in the case of a new compound being formed by the union of any given substance with an assumed *Incompatible*, the resulting body be equally and similarly active as a medicine. 2. Whether in cases of decomposition, the *Products of Exchange* be analogous in effect, and equal in energy, to the original substances. 3. Whether the new product, although insoluble in the phial, may not be soluble in the juices of the stomach. We must carefully direct our attention to each of these cases, and refer to the tables for illustration.

I. *Any given Substance having united with an assumed Incompatible, whether the resulting body be equally and similarly active as a medicine.*

531. There cannot be a doubt that, chemically considered, acids and alkalies may so neutralize each other, as to produce compounds, in which neither the properties of the one nor the other can be any longer distinguished; and should the object of the prescription be to obtain the immediate and direct action of either of such bodies upon the stomach or alimentary canal, it is evident that by their union it must be entirely frustrated; if, for instance, we require the tonic or astringent influence of *Sulphuric Acid*, we must not administer it in the form of a *Sulphate;* nor, if we intend to correct acidity in the stomach by an alkali, must we give it as a neutral salt; there are, however, many cases in which acid as well as alkaline bodies exert remote or indirect powers of a special nature, and which are not only left undiminished, but are frequently increased, by neutralization, affording examples of substances which are medicinally consistent, although chemically incompatible with each other. A few instances will render this subject intelligible. The powers of *Hydrocyanic Acid* are not impaired by its union with any of the alkalies; the *Hydrocyanates* thus formed being as active as the uncombined acid; its combination, therefore, with a fixed alkali is not only admissible, but frequently advantageous, in dyspeptic cases. In consequence of a remark made by Mr. Murray,* that a considerable dose of this acid may be given with impunity to a rabbit, if previously combined with ammonia, a question was very naturally raised as to the medicinal compatibility of this latter alkali with the acid; but the experiments of *Schubarth*† and Orfila‡ have set it at rest. The *Hydrocyanate of Ammonia* is as active as the other combinations, although ammonia, when inhaled, by operating as a diffusible stimulant, has been found service-

* Edinburgh Journal of Science, ii. 215.

† Horn's Archiv. 1824, i. 75. ‡ Toxicolog. General, ii. 167.

able in counteracting the effects of an over-dose.* *Oxalic Acid* is certainly deprived of its direct corrosive action upon the mucous membrane of the alimentary canal, but it is not disarmed of its remote virulence, by alkalies. (468.) *Arsenious Acid* is more readily absorbed, and much more manageable as a remedy, in the form of an alkaline *Arsenite*, and hence the value of the *Liquor Potassæ Arsenitis* of our Pharmacopœia. It has been already stated (35) that the alkaline effects of *Potass* or *Soda* on the urine are not impaired by their union with vegetable acids; if an alkaline antilithic be required, it may be pleasantly and effectually given in the neutral form of a *Citrate*. The organic *Alkaloids*, in consequence of their comparative insolubility, exert but feeble powers, unless in combination with acids; and provided they be soluble, the salts thus formed will display in a high degree all the powers of those bodies; but solubility either in the cup or in the stomach is essential to their action; it will indeed be seen, by a reference to the Table of Incompatibles, that vinegar deteriorates the emetic power of ipecacuan,† which would appear to offer an exception to this general law, since the *Acetate of Emeta* is not insoluble; the *Tannate*, however, of that alkaloid is pre-eminently so, and experience has shown that an *Infusion of Galls* is its most powerful antidote. The energetic alkaloid *Strychnia* is so insoluble that, unless it meet with acid in the stomach, its operation is precarious, a fact which will at once explain all the anomalies recorded of it; to obviate this uncertainty, it should be given in union with the *Acetic*, or some other acid, for all its salts are soluble; but in that case, again, if the *Acetate* be exhibited in any vehicle containing a vegetable astringent, an insoluble *Tannate* will be formed. *Tannic Acid*, and consequently the vegetable infusions which contain

* The spirit of sal ammoniac was proposed by Mead as an antidote to laurel-water.

† Dr. Irvine found that half a drachm of the powdered root, if administered in two fluid ounces of vinegar, produced only some loose stools.

it, are deprived of their efficacy by union with alkalies,* earths, and metallic oxides, since it forms with them compounds of very sparing solubility. These instances are sufficient to point out the conditions under which acids and alkalies may be reciprocally neutralized, with or without the loss of medicinal power.

532. In like manner certain salts may combine, and still retain their efficacy; for example, *Bichloride of Mercury* dissolves in a solution of *Hydrochlorate of Ammonia*, or of *Chloride of Sodium*, or *Potassium*, and the resulting double salt will be found to possess all the properties of the *Corrosive Sublimate*, with the advantage of an increased solubility, a fact of which the College has availed itself in the formula for the "*Liquor Hydrargyri Bichloridi.*" Again, the *Citrate of Iron* combines with *Ammonia*, and becomes an *Ammonio-Citrate*, by which it acquires an increased solubility without any change or diminution in its virtues; and I take the opportunity of recommending this preparation as one at once agreeable and efficacious; its solution, of a clear ruby colour, may be united with the carbonated alkalies, and given in a state of effervescence with citric acid, without decomposition; and it possesses but little of that styptic taste which renders chalybeate preparations so generally objectionable. (*Form.* 48.)

533. The observations which have been offered with respect to the union of acids and alkalies, as influencing their medicinal properties, will apply to the combinations of those vegetable principles to which Dr. Thomson has given the provisional name of "*Intermediate Bodies*," since they appear capable of forming definite compounds with other bodies, although it has not yet been ascertained by satisfactory experiments whether they ought to be classed as acids or alkalies;

* This fact has been satisfactorily proved by the failure of the practical attempts which have been made by Dr. Macbride, of Dublin, to improve the art of tanning leather by the use of lime-water, instead of pure water, which he conceived would more completely extract the virtues of the oak-bark.—(*Phil. Trans.* vol. 73, part i. art. 8.)

and let me observe, that this is a subject of considerable importance, as it regards medicinal combination, since there is scarcely a vegetable remedy that does not contain one or more of such principles; in fact, many of the obvious changes induced in infusions and decoctions by alkalies and other various reagents are to be thus explained. The extensive class of resins and resinoids falls under this denomination, such as the supposed active principle of aloes (*Aloesin*,) of colocynth (*Colocynthin*,) of jalap (*Jalapin*,) of rhubarb (*Rhein*, or *Rhubarbarin*,) &c. They combine with alkalies and form soluble solutions without loss of efficacy; they may be regarded, therefore, as *Resinates*, or *Soaps*, and when mixed with acids, the resin would appear to be separated without any material alteration; advantage of this fact may be often taken in the construction of a prescription; from the tincture of myrrh, when added to water or infusions, the resinous matter precipitated may be thus re-dissolved. The "*Lotion of Myrrh*," given to us by Kirkland as a good application for taking down fungous flesh, is composed of equal parts of the *Tincture of Myrrh* and *Lime-water*, and is, in fact, a *Resinate*, or *Soap of Lime*.

II. In cases of Decomposition, whether the Products of Exchange be analogous in medicinal effect, and equivalent in energy, to the Original Ingredients.

534. A very general notion has prevailed that the appearance of a precipitate should be at once received as an undoubted indication of some grave error in the construction of an extemporaneous prescription; and on the contrary, that its non-occurrence should be regarded as a proof that no important decomposition can have occurred amongst the compounds thus encountering each other in solution. Neither the one nor the other of these propositions can be received as a generality. It has been already stated, that the value of a remedy may occa-

sionally depend upon the production of a precipitate, (474,) and it may as readily be shown that essential changes, subversive of the medicinal virtues of the ingredients, may take place from their intermixture, without the slightest appearance of precipitation; such, indeed, must ever be the case, should the newly-formed compound happen to be soluble; thus, *Sulphuric Acid* may be added to *Lime-water*, and a *Sulphate of Lime* will be the result; but since its proportion is not too great for the water to dissolve, no precipitate will take place. A solution of *Nitrate of Silver* is not apparently disturbed by the addition of *Ammonia*, if the latter be in excess, because the resulting *Ammonio-Nitrate* is soluble. Nitric acid may be added to the *Acetate of Potass*, and *Acetic Acid* will be expelled, but no precipitate can be recognised. If we add to a solution of *Alum* an excess of alkali, no *Alumina* will be thrown down; and so in numerous instances which the reader may collect by reference to the appended tables, and which are indicated by symbols (→ ↕) that will at once arrest his attention; but in all such cases, are we to conclude from the absence of a precipitate that no essential changes can have occurred? Does not *Sulphate of Lime* differ from *Lime-water—Ammonio-nitrate of Silver* from the *Nitrate—Acetate of Potass*, from *Nitrate of Potass—Alumina*, held in solution by an alkali, from *Alum*, a salt pre-eminently characterised by an astringency which is not possessed by the earth? Again, very dilute solutions of *Potassio-Tartrate of Antimony*, according to Dr. Christison, are not disturbed by the alkalies nor by lime-water; he says that carbonate of potass does not act if the solution contains only a quarter of a grain to an ounce, and that lime-water will not produce a precipitate unless the solution contains more than half a grain. I find, however, that these bodies act with much greater delicacy than Dr. Christison ascribes to them; nor do I exactly understand his explanation of the phenomena, when he says, the first portions of the test are engaged in neutralizing the excess of acid. Is it not a basic salt? And therefore, unless contaminated with

cream of tartar, it cannot contain any excess of acid. After the sesquioxide has been thus thrown down, it may be re-dissolved by an excess of the precipitant. In like manner, the acids will precipitate the *Sesquioxide*, and take it up again when added in excess; but the integrity of the *Antimonial Compound* is undoubtedly destroyed by such means; how far the *Sesquioxide*, in a state of solution, may resemble, in medicinal activity, the salt from which it is thus separated is a question that still remains to be decided. From the Tables of Incompatible Substances the reader, directed by the appropriate symbol, (↕) may collect many other similar examples, some of which lead to inferences of great practical importance; thus, from the solutions of *Opium*, the alkalies and alkaline earths, in small proportions, will be observed to throw down the *Morphia*, and thus to render them inactive: but when added in excess, the ephemeral precipitate will be re-dissolved, and the opiate solution regain its efficacy. The *Carbonated* alkalies, however, do not possess the same redeeming power; hence Dr. Christison observes, that the "*Tinctura Opii Ammoniata*" of the Edinburgh College, is not the unchemical preparation which many have supposed it to be, since the ammonia being caustic and in excess, the morphia is dissolved; but he adds, that the *Carbonate of Ammonia* does not possess the same solvent power.

535. If we turn to the article "*Plumbi Acetas*," in the table, we shall observe a long list of substances which are regarded as incompatible with it. The subject is one which offers a convenient occasion for some practical remarks in relation to the question before us. Although I do not concur with M. Gaspard* as to the danger attendant upon the administration of this metallic salt, I entirely assent to his observation that it has been usually given in vehicles which are calculated to disarm it of its powers. I can state from very ample experience

* Experiences Physiolog. et Medical sur *L'Acetate de Plomb.* (Magendie's "Journal de Physiolog.," 3 numero, Juillet 1821.)

that as an astringent sedative, in arresting internal hæmorrhage, it is more efficient than any other known remedy, "*Nil simile nec secundum;*" but by unscientific combination it may be very readily deprived of its powers; and to this cause we may fairly refer any diversity of opinion which has existed with regard to its value. The *Compound Infusion of Roses*, or draughts containing *Sulphuric Acid*, or any soluble *Sulphate*, as that of *Magnesia*, for instance, which has very commonly accompanied it, must of necessity have rendered it inert. *Alum* also has, upon some occasions, been added, with the idea of increasing its astringency. At one period it was usual to give it in conjunction with *Sulphate of Iron;* the Pharmacopœia Bateana contains a formula of this kind, under the title of "*Tinctura Antiphthisica.** It is evident that in all the above cases an insoluble and inert *Sulphate of Lead* must be the result. The experiments of Orfila fully bear out this conclusion, since they prove that such substances act as true antidotes to the soluble salts of lead; and M. Liebig has remarked that the disease called *Painter's Cholic* is unknown in all the manufactories of white lead, in which the workmen are accustomed to take as a preservative "*Sulphuric Acid Lemonade,*" which is a solution of sugar acidulated with that acid. *Tannic Acid*, and consequently all astringents that contain it, combine with the salt of lead, and throw down a perfectly insoluble *Tannate;* indeed, many other vegetable principles decompose the salt, and combine with its oxide, as may be seen by referring to several *Infusions* in the table. It may, moreover, be observed, that *Opium* and its prepara-

* This is stated to be "a truly good medicament in those consumptions which proceed from ulcers of the lungs." The following is the receipt—

℞. Sacch. Saturni ʒij.
Sal Martis ʒi.
Infus. Spir. Vin. lb. j.
Dose, from twenty to forty drops.

tions are ranked as incompatible with it. These bodies undoubtedly decompose each other, and yet they are practically admissible in the same formula, since the *Morphia* of the opium merely exchanges its *Meconic* for *Acetic Acid*, and becomes an *Acetate* instead of a *Meconate;* while the acetate of lead is converted into an insoluble *Meconate;* a portion of the lead is thus probably rendered inert, but since the salt of lead always bears an excess in relation to the quantity of opium, the loss is of no practical moment. The practitioner may, therefore, continue to administer the *Acetate of Lead* and *Opium* in the form of pill, (*Form.* 62,) or in that of lotion, (*Form.* 63,) without incurring the censure of the chemical critic; I must, however, observe, that in this latter case he should direct the solution to be filtered. I have just seen a prescription for an eye-wash, consisting of *Acetate of Lead*, *Wine of Opium*, and *Elder-flower-water;* the chemist to whom it was sent, upon witnessing the result of the mixture, which was loaded with a flaky precipitate, hesitated as to the propriety of sending it to the patient, thinking it probable that some error might have been committed; the fact, however, was, that the practitioner had never seen the result of his formula, and had it been shown to him, it is very probable that he would not have recognised it.

536. Into various other solutions, containing compounds of the organic alkaloids, the introduction of different acids and saline bodies will frequently occasion decomposition, but the result may be nothing more than the displacement of one acid by another, according to their equivalents; and should the transfer be not accompanied with loss of solubility, the medicinal efficacy will not be affected. For example, in again referring to a solution of opium, we shall find in the table that several of the Incompatibles produce no other effect than that of exchanging the native *Meconate* for a *Nitrate*, *Sulphate*, or *Hydrochlorate of Morphia;* all of which may be regarded as *medicinally* equivalent to each other. On the contrary, however, on turning to the *Sulphate of Quina*, we shall perceive

that various salts have not only the power of decomposing it, but of rendering its base insoluble; such bodies must, of course, be considered as medicinally inconsistent with it.

537. Various instances might be adduced to show that, although an intermixture be followed by a total decomposition of the ingredients, the *Products of Exchange* are not unfrequently as active, and nearly as similar in medicinal properties; a fact which has covered many a blunder, and as often reconciled the unchemical prescriber to his ignorance. A practitioner once observed to me that the doctrine of incompatibles was one of useless refinement; "I have been told," said he, "that I must not add ammonia to Epsom salts, and yet I have been in the habit of giving such a mixture for many years with the greatest advantage." I might have informed him, that he was indebted to accident for his success, and to ignorance for his self-complacency; for in the case he adduced ammonia forms with a portion of the sulphate a double salt, the *Ammonio-sulphate of Magnesia*, while a portion of the *Magnesia* is at the same time necessarily precipitated; the whole mixed up will, without doubt, furnish a mixture of cathartic power, not far inferior, and as some suppose, less likely to gripe, than the entire sulphate. If, instead of ammonia, we add a fixed alkali to a solution of *Sulphate of Magnesia*, we shall find, by referring to the table, that these bodies demean themselves very differently, according to the proportion of carbonic acid with which they may be combined; now, should the alkali be in its caustic state, or in that of a carbonate, (*Subcarbonate* of the former Pharmacop.,) the *Magnesia* will be precipitated, and the *Sulphate of Soda* or *Potass* remain in solution; whereas, if the potass be in the state of *Bicarbonate*, or the soda in that of *Sesquicarbonate*, no precipitate will occur. This is a fact of some importance, as it is often desirable to avail ourselves of the combined effects of this saline aperient and a fixed alkali, without producing a decomposition. (*Form.* 88.)

538. It might be inferred, from a reference to the table,

that the *Trisnitrate of Bismuth* and *Carbonate of Ammonia*, as prescribed in *Form.* 53, were incompatible; but the resulting hydrate is equally active, and the proportion of ammonia converted into the nitrate is inconsiderable.

439. *Bichloride* of mercury is repeatedly presented in vehicles, or in combinations, by which it is decomposed; but it so happens that the mercurial oxide thus developed has very considerable powers, although probably inferior to those of the *Bichloride*. That this salt is also decomposed by the *Bark* is beyond all question, but the compound which results would appear to possess some power, although a different opinion was held by Swediaur, who observes, "that many authors have recommended *Sublimate* combined with *Bark*, but that a reciprocal decomposition is thus produced, by which the energies of both remedies are alike annulled;" to this ignorance, however, he thinks that many patients have been indebted for their lives; for he adds, "I see every day examples of weak and very delicate persons of both sexes, to whom ignorant practitioners prescribe, and sometimes in very large doses, the *Corrosive Sublimate* with a *Decoction of Bark*, certainly without curing the syphilis, but at the same time without occasioning those grave and dangerous symptoms which that acrid medicine would undoubtedly produce, were it given alone, or without that decoction." The opinion that bark possesses the powers of an antidote where large doses of corrosive sublimate have been taken, has been questioned; but in such small proportions, as medicinally prescribed, there are reasonable grounds for supposing that its effects may be thus diminished. Sir Astley Cooper, however, introduced a preparation of this kind to notice, which consisted of a grain of *Sublimate* to an ounce of *Tincture of Bark*, of which he gave from a drachm to two drachms twice a day, as a tonic and alterative, either in the decoction of bark or guaiacum. In cases where other mercurial preparations were found to disagree, this combination was supposed to be free from such an objection. This rather confirms the idea of its want of power.

540. The same diversity of opinion, with regard to the invalidating influence of bark upon *Corrosive Sublimate*, has prevailed with respect to the *Potassio-Tartrate of Antimony*. Cinchona certainly decomposes emetic tartar, and yet the resulting compound, according to numerous authorities, possesses all the activity of the entire salt; at the same time, however, it is but just to state, that there are several cases upon record, in which its violent effects have been arrested by a decoction of bark. A combination of those bodies in a solid form constitutes the "*Bolus ad Quertanas*" of the French, and is regarded as a purgative. The *Emeto-Purgative* of the French school, consisting of the mixed solutions of *Tartar Emetic* and *Sulphate of Soda*, is not the unchemical combination which some have supposed it to be; if we refer to these articles in the Tables of Incompatibles, we shall find that the antimonial salt is not decomposed by a *neutral* sulphate.

541. For the promotion of the emetic operation of tartar emetic, it is a popular practice to administer draughts of some vegetable infusion; the scientific practitioner will wisely offer a caution as to the use of such as are known to decompose it, such, for example, as strong tea; whereas an infusion of chamomile, or wormwood, has no such effect.

542. In appreciating the medicinal, as well as chemical objections, to a precipitate, we must remember that in organic bodies there exist certain incidental elements which may not have any relation to their medicinal properties; we are not, therefore, necessarily to infer, without inquiry, that any principle of activity has been thus removed. *Sulphate of Soda* will throw down a precipitate from yellow bark, which is nothing more than *Sulphate of Lime*. *Diacetate of Lead*, which produces a copious precipitate in the coloured solutions of *emeta*, has no action whatever upon it when it is pure. The *Sulphuric* and *Phosphoric* acids throw down precipitates from the infusion of chamomile, but they consist only of *Sulphate*, or *Phosphate of Lime*.

Vegetable precipitates, however, ought always to be viewed

with suspicion; if useless, they should be removed, as they render the draught unnecessarily disagreeable; if they contain active matter, they may remain behind in the phial, and thus escape being swallowed, *unless* properly suspended by some appropriate medium.

543. It is not possible to furnish any general theorem that may enable the practitioner to avoid mixing together substances which are chemically incompatible; a knowledge of their composition and habitudes must in every case direct him; and it is hoped that the junior practitioner, by studying the tables now introduced, will be led to an investigation that will put him in full possession of the subject. It may also be useful for him to retain in his remembrance the simple and beautiful law so ably developed by the eminent author of the "STATIQUE CHIMIQUE"—*viz.* that, "*Whenever two salts in a state of solution are brought together, which contain within themselves the elements capable of producing a* SOLUBLE, *and an* INSOLUBLE *salt, a decomposition will arise.*" This law he illustrates by the example of *Nitrate of Silver* and *Chloride of Potassium*, whose elements are capable of forming amongst themselves an insoluble *Chloride of Silver*, and a soluble *Nitrate of Potass.* The reader may also, by a reference to the tables, derive many other instructive instances, and the frequent concurrence of the symbols denoting precipitation (↓) and solution (→) will at once afford a graphic illustration of this general truth.

544. It should be also known that a Table of Chemical Affinities will not prove an unerring guide. In cases, for example, where a *super* or *sub* salt is readily formed, *a substance less feebly attracted by another than a third, will sometimes precipitate this third from its combination with the second;* thus, in the production of *Nitric Acid*, we decompose the *Nitrate of Potass* by virtue of the superior affinity of the *Sulphuric Acid* for its base; the *Nitric Acid* is accordingly disengaged, and a *Sulphate of Potass* remains in the retort; now, paradoxical as it may appear, if upon this *Sulphate of Potass*, *Nitric Acid* be poured, a quantity of *Nitre* will be reproduced, in consequence

of the saturation of such a proportion of the base, as will enable the remaining atoms to form a *Bi*-sulphate of potass. In the same manner the *Tartrate of Potass* (*soluble tartar*) is, contrary to the usual law of affinity, decomposed by all *sub-acid* vegetables, and even by *carbonic acid*, in consequence of their combining with one half of the base, so as to convert it into a *Bi*-tartrate.

545. There are also cases in which the production of double salts gives rise to apparent anomalies. We have a very ready illustration of this fact in the decomposition of the "*Liquor Ammoniæ Acetatis*" by *Magnesia*. If the practitioner should refer to a table of affinities, he will see that *Acetic Acid* has a greater attraction for *Ammonia* than for *Magnesia;* but if upon this assurance he were to administer these salts in conjunction, which to my knowledge has occurred, his patient would soon discover, to his extreme discomfort, that he had swallowed a very pungent solution of ammonia; now, in this case, the *Magnesia* forms a double salt (*Ammonio-acetate of Magnesia*) with one portion of the ammonia, and consequently sets the rest at liberty.

546. In ordering saline draughts as vehicles for active medicines, it is very important that they should be rendered perfectly neutral; the effect of a predominating acid or alkali may produce decompositions fatal to the efficacy of the remedy, as the practitioner will fully understand by a reference to the *Acetate of Ammonia*, and other preparations in the Table of Incompatibles. In prescribing them to be taken in a state of effervescence, we must consider whether the disengaged carbonic acid may not invalidate the powers of the remedies simultaneously given with them. I should certainly recommend such a form to be avoided, in all cases where a salt of lead had been administered, for the carbonic acid retained in the stomach might probably convert it into a *carbonate*.

547. In concluding this division of the subject, it may be observed that it is the paramount duty of the practitioner to be

well acquainted, not only with the composition of his medicines, but with the appearance which they ought to present; he is not unfrequently called upon by the patient or his friends to inspect a mixture, from a suspicion of its having been incorrectly prepared; and should he be unable to decide the question, he will either betray his own deficiency, or unjustly cast a censure upon those who dispensed it. I have known a practitioner, under such circumstances, to express his dissatisfaction at an abundant precipitate which he ought to have known was the necessary consequence of his prescription; and so again with respect to colour, he has added a syrup to render it red, and the ingredients, contrary to his expectation, have turned it green.

III. Whether the new Products, arising from Decomposition, although Insoluble in the Phial, may not become soluble in the juices of the stomach, or undergo such farther Changes in the System, as may render them medicinally active.

548. In treating the question of *Incompatibility*, authors have very generally limited their inquiries to the chemical nature of any two or more substances brought into contact in the vessels of the laboratory, and to the effects resulting from such intermixture; they have paid but little attention to the organic principles with which they may unite in the stomach, and to the essential changes of composition, to which such combinations may give rise. From the various observations scattered through the preceding pages, the reader must have anticipated the fact, that substances totally insoluble in water may be soluble in the animal fluids, and that medicinal compounds may undergo changes in their transit through the vital organs (34—37) which he could not have inferred from a

knowledge of their chemical habitudes. According to the latest researches, it is evident that the secretions of the stomach are liable to important variations; at one time they may be neutral, at another, acid: and the nature of the acids may also differ; they may be either *Acetic*, or *Hydrochloric*, or a mixture of both; and then again they may be combined with different bases, and different organic principles, (221, &c.) If we require any practical proof of the variable state of this secretion, the precarious operation of *Magnesia* would afford it, for this earth will only display purgative properties when it meets with an acid. By analogy we may suppose other medicinal bodies to be similarly influenced. *Strychnia* may prove active in one condition of the stomach, and perfectly inactive in another. By referring to the tables, it will be seen that *Quina* forms with *Tannic Acid* an insoluble compound, but should it meet with acetic acid in the stomach it would be rendered soluble and active; in like manner the *Tannates of Morphia and Codeia* might be rendered effectual. On the other hand, in the total absence of acid in the alimentary canal, several of our remedies might undergo an injurious decomposition from the alkaline reaction of the duodenal fluids. Nor are the saline bodies existing in the gastric secretion without their influence; there is reason to conjecture that the *Hydrochloric Salts* may convert a portion of the *Chloride* into the *Bichloride* of mercury. *Nitrate of Silver* is also thus converted into the *Chloride;* but which, when in union with *Albumen*, is, according to the experiments of Mitscherlich, soluble in acetic acid. I have already alluded to the views of Berzelius regarding the manner in which metallic oxides enter the circulation, in consequence of their combination with albumen, (36.) A difference of opinion has been held with respect to the incompatibility of *Iodide of Potassium* and *Starch*, since no action takes place between them, but an acid in the stomach would immediately liberate the *Iodine*, with which an *Iodide of Starch* would be formed. The *Tartrate of Potass* is a salt very liable

to vary in its purgative effect, which may perhaps be explained by an excess of acid in the stomach, converting it into *Bitartrate*, or cream of tartar. Certain metals possess decided powers, for which they can be alone indebted to the solvent properties of the animal secretions. *Iron* thus announces its activity by the blackness of the fæces. Mercury may also, under peculiar circumstances, acquire medicinal powers. *Antimony* and its *Sulphuret*, by meeting with an acid, will become either emetic or purgative; the recorded effects of the "*Antimonial Cup*" must be well known to every member of our college. The "*Everlasting Pill*," * although more precarious in its operation, may have been indebted for its occasional powers to an acid in the *primæ viæ*. The metallic *Sulphurets*, according to the experiments of M. Decourdemanche,† are, by the action of the animal fluids, rapidly changed into oxides; their water furnishing hydrogen to the sulphur, and oxygen to the metal, the decomposition of which is promoted by the presence of organic matter. In this way we may explain the action of acids upon the oxysulphuret of antimony, which are liable to render it emetic.

549. It has been stated that redundant mucus, in the first passages, may modify the activity of a remedy, and that this may be obviated by certain expedients. (407.)

550. The above observations are sufficient to excite the attention of the scientific physician to a subject which requires for its elucidation the combined advantages of chemical knowledge and medical experience, and to satisfy him that the in-

* The Everlasting Pill was composed of metallic antimony, which was believed to have the property of purging, as often as it was swallowed. This was economy in right earnest, for a single pill would serve a whole family during their lives, and might be transmitted as an heirloom to their posterity. We have heard of a lady who, having swallowed one of these pills, became seriously alarmed at its not passing; "Madam," said her physician, "fear not; it has already passed through a hundred patients without any difficulty."

† Jour. de Pharmacie, xiii. 217.

quiry is not so hopeless as many have supposed. It is true that our present very limited knowledge is incapable of being usefully generalized, but it may occasionally serve us in explaining apparent anomalies in the operation of particular medicines. From the uncertain and varying state of the animal juices, it is not likely that we shall be able to command their services as *Adjuvants*, but we may sometimes prevent their becoming obstacles to our remedies. (214.)

A SYNOPSIS OF SUBSTANCES

USUALLY CONSIDERED AS

INCOMPATIBLE

WITH THE DIFFERENT ARTICLES OF THE MATERIA MEDICA;

AND OF THE

RESULTS OF THEIR MUTUAL ACTIONS.

OBSERVE—The arrow reversed ↓ denotes that the product against which it is placed is precipitated. The double arrow, ↕ that it is re-dissolved by an excess of the Precipitant. The arrow horizontally placed,→ that it is retained in solution, and the upright arrow ↑ that the evolved principle is volatilized.

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
ACIDUM HYDROCYANICUM DILUTUM.	Acids, Mineral.	*No effect*, if moderately dilute; *strong Sulphuric*, and especially *Nitric Acid*, would probably decompose it.
	Acetate of Lead.	*No effect.*
	Bichloride of Mercury.	*No effect.*
	Binoxide of Mercury.	*Bicyanide of Mercury.*→
	Nitrate of Silver.	*Cyanide of Silver.*↓
	Saline Draught of Citrate of Potass.	*No effect.*
	Ditto, with excess of Alkali.	*Cyanide of Potassium.*→
	Salts of Iron.	*No effect*, unless an alkali be introduced; and in that case the formation of *Prussian-blue* will not take place, unless the *Protoxide* and *Peroxide* of Iron be both present.
	Strychnia.	*Hydrocyanate of Strychnia.*→
	Sulphate of Copper.	White *Cyanide of Copper*,↓ with very minute amber-coloured crystals. The solutions, on being first intermixed, assume a deeper blue colour, but eventually become paler.

Acidum Nitricum.	Hydrochloric Acid.	*Chlorine* and *Nitric Oxide*, if not too dilute.
	Alcohol.	*Hyponitrous Æther.*
Acidum Phosphoricum Dilutum.	Lime-water.	*Phosphate of Lime.* ↕
	Nitrate of Silver.	No effect, unless an alkali be present, in which case a *Phosphate of Silver* will be formed. ↓
	Carbonate of Soda.	*Phosphate of Soda*, → and *Carbonic Acid Gas.* ↑
	Strychnia.	*Phosphate of Strychnia.* →
	Vegetable infusions containing Calcareous Salts.	*Phosphate of Lime.* ↓
Alumen.	Alkalies. Their Carbonates.	*Hydrate of Alumina*, ↕ * and *Alkaline Sulphate.* → *Hydrate of Alumina.* ↓
	Creta Præparata.	*Sulphate of Lime*, ↓ *Hydrate of Alumina*, ↓ and *Carbonic Acid.* ↑

* Unless the Alkali be added in sufficient quantity, the Alumina will retain a portion of Sulphuric Acid, and be precipitated as a *Subsulphate*, which an excess of Alkali will dissolve.

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
ALUMEN.	Lime.	*Sulphate of Lime*, ↓ and *Hydrate of Alumina.* ↓
	Lime-water.	*Sulphate of Lime*, → and *Hydrate of Alumina.* ↓
	Acetate of Lead.	*Sulphate of Lead*, ↓ and *Acetate of Potass* → or *Alumina*, ↓ or both.
	Tartrate of Potass.	*Sulphate* ↓ and *Bitartrate of Potass*, ↓ with *neutral Sulphate of Alumina.* →
	Vegetable Extractive matter.	*Insoluble Precipitate.**
	Tincture of Galls.	*Slightly turbid mixture.*
	Magnesia and its Carbonate.	*Sulphate of Magnesia*, → and *Hydrate of Alumina*, ↓ with *Carbonic Acid* ↑ from the carbonate.

* In consequence of this property to combine with vegetable extractive matter, Alum is employed to clear water when turbid from such impurities.

Ammoniæ Acetatis Liquor. (If perfectly neutral.)	Acids.	*Ammoniacal Salts*,→ with *Acetic Acid*. ↑
	Fixed Alkalies and their Carbonates.	*Ammonia* ↑ by the Caustic Alkalies; and *Carbonate* ↑ by the Carbonates; with *Acetates* of the bases.→
	Lime-water.	*Ammonia*, ↑ and *Acetate of Lime*.→
	Magnesia.	*Ammonio-Acetate of Magnesia*,→ and *Ammonia*. ↑
	Bichloride of Mercury.	*No effect.*
	Sulphate of Iron.	*No effect.*
	Sulphate of Zinc.	*No effect.*
	Nitrate of Silver.	Crystalline Precipitate of *Acetate of Silver*, soluble in water.
	Acetate of Lead.	*Carbonate of Lead*, ↓ from the Carbonic Acid diffused through the solution.
Ditto. (Carbonate of Ammonia being in excess.)	Lime-water.	*Carbonate of Lime*, ↓ and *Ammonia*. ↑
	Bichloride of Mercury.	*Ammonio-Chloride of Mercury*. ↓

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
Ditto. (Carbonate of Ammonia being in excess.)	Potassio-Tartrate of Antimony.	*Sesquioxide of Antimony.* ↕
	Sulphate of Iron.	*Protocarbonate of Iron.* ↓
	Sulphate of Zinc.	*Carbonate of Zinc.* ↕
	Nitrate of Silver.	*Carbonate of Silver.* ↓
	Acetate of Lead.	*Carbonate of Lead,* ↓ and *Ammonio-Acetate of Lead.*→
Ditto. (Acetic Acid being in excess.)	Lime-water.	*Acetate of Lime,*→ without at first any evolution of *Ammonia*, but the continued addition of Lime-water will eventually eliminate it. ↑
Ammoniæ Citras. (With an excess of Citric Acid.)	Acetate of Lead.	*Citrate of Lead,* ↓ and *Acetate of Ammonia.*→
	Sesquioxide of Iron.	*Ammonio-Citrate of Iron.*→
	Magnesia.	*Ammonio-Citrate of Magnesia,*→ and *Ammonia.* ↑

Ammoniæ Hydrochloras.	Potass, Soda, Lime, and Magnesia.	*Ammonia*, ↑ and *Chlorides* of the respective bases.→
	Nitric Acid.	*Chlorine*, ↑ and *Nitrate of Ammonia*.→
	Sulphuric Acid.	*Hydrochloric Acid*, ↑ and *Sulphate of Ammonia*.→
Ammoniæ Liquor.	Acids, and Acidulous Salts.	*Ammoniacal Salts*, with the Acids;→ *Double Salts*, with Acidulous Salts in many cases.
	Earthy salts; except those of Lime and Baryta.	The *Earth*, ↓ and an *Ammoniacal Salt* formed with its respective Acid.→
	Metallic salts.	In most cases the precipitation of the *Metallic Oxide* in the state of *Hydrate*.
Ammoniæ Sesquicarbonas.	Potass, Soda, and their Carbonates. Magnesia.	By the abstraction of its Carbonic Acid, is rendered more pungent.
	Acids.	*Ammoniacal Salts*,→ and *Carbonic Acid*. ↑
	Lime-water.	*Ammonia*, ↑ and *Carbonate of Lime*. ↓
	Metallic Salts.	Commonly *Metallic Carbonates*. ↓

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
ANTIMONII POTASSIO-TARTRAS. *Tartar Emetic.*	Alkalies, especially their Carbonates.	*Sesquioxide of Antimony,* ↕ *and Alkaline Tartrates.*→
	Lime-water.	*Sesquioxide of Antimony,* ↕ and *Tartrate of Lime.* ↓
	Alum, and Bisulphates.	*Sulphate of Antimony.* ↓
	Neutral Sulphates.	*No decomposition.*
	Acids (Mineral).	*Sesquioxide of Antimony.** ↕
	Acids, Tartaric and Citric.	*A slight haze* in the solution, but no precipitate.
	Acetic Acid.	*No Precipitate.*
	Bichloride of Mercury.	*Calomel,* ↓ and *Chloride of Antimony.* ↓
	Acetate of Lead.	*Tartrate of Lead,* ↓ and *Acetate of Antimony.*→
	Ditto, with Acetic Acid.	*No Precipitate*, probably an *Aceto-Tartrate of Lead* formed.→

* The Sulphuric Acid must be added in large excess to re-dissolve it.

Antimonii Potassio-Tartras.	Infusion, Decoction, and Tincture of Bark.	*Mutual Decomposition, Tannate of Antimony*, ↓ *&c.*
	Astringent Vegetable Infusions.	White *Tannate of Antimony.* ↓ or the solution rendered muddy.
Argenti Nitras.	Spring and River Water.	*Chloride of Silver.* ↓
	Caustic Fixed Alkalies. Lime-water.	*Oxide of Silver.* ↓
	Carbonated Fixed Alkalies.	*Carbonate of Silver.* ↓
	Ammonia.	*Oxide of Silver*, ↓ but, if in excess, *Ammonio-Nitrate of Silver.*→
	Soluble Chlorides. Hydrochlorates. Hydrochloric Acid.	*Chloride of Silver.* ↓
	Sulphuric Acid and Sulphates.	*Sulphate of Silver*, if concentrated, which dissolves on the addition of water.
	Phosphoric Acid.	*No effect.*
	Phosphates of Soda, &c.	*Phosphate of Silver*, ↓ and *Acetate of Soda.*→
	Tartrate of Potass.	*Tartrate of Silver*, ↓ and *Acetate of Potass.*→

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
Argenti Nitras.	Carbonate of Ammonia.	*Carbonate of Silver*, ↕ and *Nitrate of Ammonia.*→
	Solution of Soap.	*Stearate, &c. of Silver*, ↓ and *Nitrate of Potass.*→
	Solution of Arsenite of Potass.	*Arsenite of Silver*, ↓ and *Nitrate of Potass.*→
	Hydrocyanic Acid.	*Cyanide of Silver*, ↓ and *Nitric Acid.*
	Iodide of Potassium.	*Iodide of Silver*, ↓ and *Nitrate of Potass.*→
	Astringent Vegetable Infusions.	*Decomposition.*
Belladonna. Hyoscyamus ? Stramonium ?	Caustic Alkaline Solutions.	Decompose *Atropia*, and render it inert.*
Bismuthi Trisnitras.	Ammonia.	*Hydrate of Bismuth*, ↓ and *Nitrate of Ammonia.*→
	Potass and Soda.	*Hydrate of Bismuth*, ↓ and *Nitrate of Potass*, or *Soda.*→

* Brandes had detected a vegetable Alkali in *Belladonna*, which he termed *Atropina*. Succeeding chemists, not being able to find this Alkali, denied its existence, until Runge explained their failure, by showing that a caustic Alkali which they had employed, even though weak, was capable of decomposing *Atropina*. By substituting magnesia, he not only obtained it from *Belladonna*, but from *Hyoscyamus* and *Stramonium ;* and he has shown that the properties of these three bodies so resemble each other, as to make it highly probable that they contain one common principle of activity.

Bismuthi Trisnitras.	Nitric Acid.	*Nitrate of Bismuth.*→
	Vegetable Astringents.	*No immediate effect.*
Calcii Chloridi Liquor.	Sulphuric Acid and its Salts, (except that of Lime.)	*Sulphate of Lime.* ↓
	Potass and Soda.	*Lime,* ↓ and *Chloride of Potassium,* or *Sodium.*→
	Carbonates of Potass and Soda.	*Carbonate of Lime,* ↓ and *Chloride of Potassium,* or *Sodium.*→
	Ammonia.	*No effect.*
	Carbonate of Ammonia.	*Carbonate of Lime,* ↓ and *Hydrochlorate of Ammonia.*→
	Carbonate of Magnesia.	*No effect.*
Calcis Liquor.	Acids and Acidulous Salts, e. g.—	Various *Salts of Lime.*
	Nitric, Hydrochloric, Acetic acid	*Nitrate,*→ *Acetate of Lime,*→ and *Chloride of Calcium.*→
	Phosphoric, Tartaric, Citric	*Phosphate,* ↕ *Tartrate,* ↕ and *Citrate of Lime.* ↕

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
Calcis Liquor.	Hydrochlorate of Ammonia.	*Chloride of Calcium*,→ and *Ammonia*.↑
	Alkaline Carbonates.	*Carbonate of Lime*,↓ and *Caustic Alkalies*.→
	Sesqui-carbonate of Ammonia.	*Carbonate of Lime*,↓ and *Ammonia*.↑
	Soap.	*Stearate*, *Margarate*, and *Oleate of Lime*.↓
	Vegetable Astringents.	*Tanno-gallate of Lime*.↓
	Alum.	*Hydrate of Alumina*,↓ and *Sulphate of Lime*.→
	Sulphates of Iron and Zinc.	*Hydrated oxides of Iron* and *Zinc*,↓ and *Sulphate of Lime*.→
	Sulphate of Magnesia.	*Hydrate of Magnesia*,↓ and *Sulphate of Lime*.→
	Chloride of Mercury.	*Protoxide of Mercury*,↓ and *Chloride of Calcium*.→
	Bichloride of Mercury.	*Binoxide of Mercury*,↓ and *Chloride of Calcium*.→
	Nitrate of Silver.	*Oxide of Silver*,↓ and *Nitrate of Lime*.→

CRETA PRÆPARATA. Hydrargyrum cum Creta. Confectio Aromatica. Mistura Cretæ C.	Acids, and Acidulous Salts.	*Calcareous Salts*, and *Carbonic Acid.* ↑
	Alum.	*Sulphate of Lime*, ↓ and *Carbonic Acid.* ↑
	Hydrochlorate of Ammonia.	Slow and very slight decomposition.
CUPRI AMMONIO-SULPHAS.	Acids.	*Cupreous* and *Ammoniacal Salts*,→ with *Carbonic Acid.* ↑
	Potass and Soda.	*Sulphate of Potass* and *Soda*, with a *Cupreous Compound*, ↓ and *Ammonia.* ↑
	Lime Water.	*Sulphate of Lime*,→ *Ammonia*, ↑ and a *Cupreous Compound.* ↓
CUPRI SULPHAS.	Fixed Alkalies.	*Hydrated Oxide*, ↓ or *Disulphate of Copper*, ↓ according to the proportion of the Precipitant.
	Ammonia.	*A perfect Solution of Ammonio-Sulphate.*
	Sesquicarbonate of Ammonia.	*Carbonate of Copper*, ↓ and *Sulphate of Ammonia*;→ or, should the Sesquicarbonate be in excess, an *Ammonio-Sulphate of Copper*,→ and *Carbonic Acid.* ↑

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
Cupri Sulphas.	Carbonate of Potass or Soda.*	*Carbonate of Copper*, ↓ and *Sulphate of Potass*, or *Soda*.→
	Bichloride of Mercury.	*No effect.*
	Arsenite of Potass.	*Arsenite of Copper*, ↓ and *Sulphate of Potass*.→
	Nitrate of Silver.	*Sulphate of Silver*, ↓ and *Nitrate of Copper*.→
	Acetate of Lead.	*Acetate of Copper*,→ and *Sulphate of Lead*. ↓
Ferri Ammonio-Chloridum.	Alkalies and their Carbonates.	*Sesquioxide of Iron*, ↓, *Alkaline Chlorides*,→ and, if Alkali be added in excess, *Ammonia* ↑
	Lime.	As above, but with *Chloride of Calcium*.→
	Astringent Infusions, &c.	*Tanno-gallate of Iron*. ↓
Ferri Iodidum.	Potass and Soda.	*Hydrated Protoxide of Iron*, ↓ and *Iodide of Potassium*, or *Sodium*.→
	Lime Water.	*Hydrated Protoxide of Iron*, ↓ *and Iodide of Calcium*.→
	All substances incompatible with Sulphate of Iron.	See Ferri Sulphas.

* M. Benoist gave the different Salts of Copper, together with Carbonate of Soda, to animals, and in every case it proved inert.—*Journ. de Chem. Med.*

Ferri Potassio-Tartras.	Acids, Mineral.	*Bitartrate of Potass.* ↓ and *Pernitrate, Persulphate, or Perchloride of Iron.*→
	Lime Water.	*Tartrate of Lime*, ↓ and *Sesquioxide of Iron.* ↓
	Ammonia and its Sesquicarbonate.	*No effect*,* at any temperature.
	Potass, Soda, and their Carbonates.	*No effect*, unless heated,** and then the *Caustic*, but not the *Carbonated Alkalies*, will give *Alkaline Tartrates*,→and *Sesquioxide of Iron.* ↓
	Vegetable Astringents.	*Tanno-gallate of Iron.* ↓
Ferri Sesquioxydum.	Nitric Acid.	*Pernitrate of Iron.*→
	Hydrochloric Acid.	*Sesquichloride of Iron.*→
	Sulphuric Acid.	*Persulphate of Iron.*→
	Acidulous Salts, as Bisulphate of Potass.	*Persulphate of Iron*,→ and *Sulphate of Potass.*→

* Klaproth first noticed the important fact, that the presence of a certain proportion of Tartaric Acid in any of the acid solutions of Oxide of Iron, prevented precipitation by an alkali.

** It is on this account that Ammonia is preferred to the fixed alkali, in the preparation of *Ferri Potassio Tart.*, for neutralizing any excess of acid.

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
Ferri Sesquichloridi Tinctura.	Alkalies and their Carbonates.	*Hydrated Sesquioxide of Iron*, ↓ and *Chlorides*, or *Hydrochlorates* of their bases.→
	Lime Water, Carbonate of Lime, Magnesia, and its Carbonate.	*As above.*
	Solution of Gum.	Precipitation in *Gelatinous flakes.* ↓
	Vegetable Astringents.	*Tanno-gallate of Iron.*
Ferri Sulphas.	Nitric Acid.	*Persulphate of Iron*, ↓ and *Nitric Oxide.* ↑
	Potass and Soda.	*Hydrated Protoxide of Iron*, ↓ and *Sulphate of Potass*, or *Soda.*→
	Carbonates of the Alkalies.	*Protocarbonate of Iron*, ↓ and *Alkaline Sulphates.*→
	Lime Water.	*Hydrated Protoxide of Iron*, ↓ and *Sulphate of Lime.*→
	Nitrate of Potass.	*No effect when dilute.*
	Tartrate of Potass.	*Prototartrate of Iron*, ↓ and *Sulphate of Potass.*→
	Acetate of Lead.	*Acetate of Iron*, and *Sulphate of Lead.*

Ferri Sulphas.	Biborate of Soda.	*Borate of Iron*, ↓ and *Sulphate of Soda.*→
	Iodide of Potassium.	*Iodide of Iron*,→ and *Sulphate of Potass.*→
	Vegetable Astringents.	*Tanno-gallate of Iron.* ↓
Ferri Mistura Composita.	Acids. Acidulous Salts.	Salts of *Protoxide of Iron*, or *Double Salts*, and *Carbonic Acid.* ↑
	Nitric Acid.	Peroxidation of the *Protocarbonate, Pernitrate of Iron*,→ and *Carbonic Acid.* ↑
	Astringent Infusions.	*Tanno-gallate of Iron.* ↓
Guaiaci Tinctura Composita.	Water.	*Guaiac Resin.* ↓
	Nitric Acid. Spirit of Nitric Æther.	The *Guaiac Resin* separated into coagulated masses, of a bluish-green colour.
	Acids and Acidulous Salts.	*Ammoniacal Salts* of the respective acids ;→ *Guaiac Resin*, ↓ and *Carbonic Acid.* ↑
	Earthy and Metallic Salts.	*Ammoniacal Salts* of the respective acids,→ *Carbonates* of the *Earths*, ↓ or *Metallic Oxides*, ↓ and precipitation of them with the *Guaiac Resin.*

* If a solution of Sulphate of Iron be long exposed to the air, a *Disulphate of the Peroxide* falls down in the state of *Hydrate*, of an ochreous colour. This may be prevented by the previous addition of a few drops of dilute Sulphuric Acid. For the same reason, unless the water has been recently boiled, the air which it contains will render the solution of the Sulphate turbid.

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
HYDRARGYRI AMMONIO-CHLORIDUM.	Hydrochloric Acid.	*Hydrochlorate of Ammonia*,→ and *Bichloride of Mercury*.→
	Potass and Soda.	Partial decomposition—*Chlorides of the Metals*,→ *Ammonia*,↑ and a *yellow residue*.→
HYDRARGYRI CHLORIDUM. *Calomel.*	Ammonia, Potass, Soda, and Lime.	*Protoxide of Mercury*,↓ and *Chloride of Potassium*, *Sodium*, or *Calcium*.→
	Hydrochlorate of Ammonia, Chlorides of Potassium and Sodium.	A small portion of *Bichloride*,→ and separation of *Metallic Mercury*.↓
	Carbonate of Ammonia.	*Protoxide of Mercury*,↓ and *Hydrochlorate of Ammonia*.→
	Carbonates of Potass and Soda.	Similar in kind to the results produced by the caustic alkalies, but slower in taking place, and less perfect.
	Nitric Acid.	*Bichloride*,→ and *Nitrate of Mercury*.→
	Salts of Iron. Lead. Copper.	*No effect.*
	Iodide of Potassium.	*Protiodide of Mercury*,↓ and *Chloride of Potassium*.→
	Soaps.	*No effect.*
	Bicarbonate of Potass.	*No decomposition*, unless heated.

HYDRARGYRI BICHLORIDUM. *Corrosive Sublimate.*	Potass, Soda, and Lime.	If the alkalies be in excess, yellow *Hydrated Binoxide of Mercury*; ↓ but if deficient in quantity, reddish *Oxychloride of Mercury*, ↓ together with the *Chlorides* of the bases of these alkaline bodies.→
	Carbonates of Potass and Soda.	Either *Sub-oxychloride*, or a mixture of *Oxychloride* and *Binoxide of Mercury*, ↓ and *Chlorides of Potassium*, or *Sodium*.→
	Carbonates of Lime.	*Oxychloride of Mercury*, ↓ and *Chloride of Calcium*.
	Ammonia.	*Ammonio-Chloride of Mercury*. ↓
	Carbonate of Ammonia.	*Ammonio-Chloride of Mercury*, ↓ and *Hydrochlorate of Ammonia*.→
	Potassio-Tartrate of Antimony.	*Calomel*, ↓ and *Chloride of Antimony*. ↓
	Nitrate of Silver.	*Chloride of Silver*, ↓ and *Pernitrate of Mercury*.→
	Acetate of Lead.	If the solutions be strong, *Chloride of Lead*, ↓ and *Peracetate of Mercury*.→
	Hydrochlorate of Ammonia, Chloride of Sodium.	Very soluble double Salts.
	Soaps.	*Stearates*, *Oleates*, and *Margarates of Mercury*, ↓ and *Chlorides of Potassium*, or *Sodium*.→

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
HYDRARGYRI BICHLORIDUM. *Corrosive Sublimate.*	Albumen.	Copious Precipitation.
	Gelatin.	*No effect.*
	Decoction of Bark.	*Muddy Precipitate* containing *Mercury.* ↓ Probably a triple compound.
	Infusion of Tea.	*An abundant Precipitate of a fawn colour.*
	Fixed Oils.	*No effect.*
	Iodide of Potassium.	*Biniodide of Mercury.* ↕
HYDRARGYRI BINOXYDUM. AND HYDRARGYRI NITRICO-OXYDUM.	Hydrochloric Acid.	*Bichloride of Mercury,*→ and with crystals of the same.
	Nitric Acid.	*Pernitrate of Mercury.*→
	Sulphuric Acid.	*Subpersulphate*, *Persulphate*, or *Bipersulphate*, according to the relative quantities employed.
HYDRARGYRI OXYDUM.	Hydrochloric Acid.	*Protochloride of Mercury,*→ and *Water.*
	Acetic Acid.	*Protacetate of Mercury,*→ and with crystals.
	Nitric Acid.	Solution of the *Protonitrate*, if the acid be dilute; and of *Pernitrate*, if strong.
	Sulphuric Acid.	*Protosulphate of Mercury.* ↓

HYDRARGYRUM (*cum Creta.*)	Acetic Acid.	*Mercury*, ↓ *Acetate of Lime*,→ and *Carbonic Acid.* ↑
	Sulphuric Acid.	*Sulphate of Lime*, ↓ *Mercury*, ↓ and *Carbonic Acid.* ↑
	Alum.	*Sulphate of Lime*, ↓ *Mercury*, ↓ and *Hydrate of Alumina.* ↓
	Nitric Acid. (*If very dilute.*)	*Protonitrate of Mercury*,→ and *Nitrate of Lime*,→ with *Carbonic Acid.* ↑
	Nitric Acid. (*If moderately strong.*)	*Pernitrate of Mercury*,→ and *Nitrate of Lime*,→ with *Carbonic Acid.* ↑
	Hydrochloric Acid.	*Chloride of Calcium*,→ *Metallic Mercury*, and *Carbonic Acid.* ↑
HYDRARGYRI IODIDUM.	Sulphuric, Nitric, and Hydrochloric Acids, and Iodide of Potassium.	Slightly soluble in.
	Chloride of Sodium.	Insoluble in solution of.

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
HYDRARGYRI BINODIDUM.	Sulphuric, Nitric, and Hydrochloric Acids; and Iodide of Potassium.	Soluble in solutions of.
	Chloride of Sodium.	Totally soluble in solution of.
IODINIUM. (*Spirituous solution of.*)	Starch, (*Aqueous solution of.*)	*Iodide of Starch*, of a characteristic blue colour.
IPECACUANHÆ VINUM.	Tincture of Galls.	*Tanno-gallate of Emeta.* ↓
	Vinegar.	*Acetate of Emeta*, (comparatively inert.)
	Acetate of Lead.	Precipitate.
MAGNESIA.	Acids and Acidulous Salts.	Various *Magnesian Salts.*→
	Metallic Salts.	Ditto, with *Metallic Hydrates* or *Oxides.* ↓
	Hydrochlorate of Ammonia.	*Chloride of Magnesium* and *Ammonia*;→ with *Ammonia.* ↑
MAGNESIÆ CARBONAS.	Acids, and Acidulous Salts.	*Magnesian Salts*,→ with *Carbonic Acid.* ↑
	Metallic Salts.	*Metallic Carbonates.* ↓
	Hydrochlorate of Ammonia.	*Chloride of Magnesium* and *Ammonia*,→ with *Carbonate of Ammonia.* ↑

Magnesiæ Carbonas.	Lime Water.	*Carbonate of Lime*, ↓ with *Magnesia*. ↓
	Bitartrate of Potass.	*Tartrate of Magnesia and Potass*, and *Carbonic Acid*. ↑
Magnesiæ Sulphas.	Ammonia.	*Magnesia*, ↓ together with a double Salt of *Magnesia and Ammonia*.→
	Acetate of Lead.	*Sulphate of Lead*, ↓ and *Acetate of Magnesia*.→
	Chloride of Calcium.	*Sulphate of Lime*, ↓ and *Chloride of Magnesium*.→
	Lime Water.	*Hydrate of Magnesia*, ↓ and *Sulphate of Lime*.→
	Potass and Soda, or their Carbonates.	*Hydrate*, or *Carbonate of Magnesia*, ↓ and *Sulphates of the Alkalies*.→
	Bicarbonate of Potass, and Sesquicarbonate of Soda.	No decomposition.
Mistura Cascarillæ Composita.	Alkalies, their Carbonates, Earths and their Carbonates, and whatever is generally incompatible with Acids. Salts of Iron.	*Acetates* of the respective Bases; together with *Benzoates*. *Tanno-gallate of Iron*. *See Infus. Cascarillæ*.
Morphiæ Acetas.	Ammonia.	*Morphia*, ↕ and *Acetate of Ammonia*.→
	Alkaline Carbonates.	*Carbonate of Morphia*. ↓

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
Morphiæ Acetas.	Substances incompatible with Infusion of Opium, except Acetate of Lead.	See Infusion of Opium.
Morphiæ Hydrochloras.	Acetate of Lead.	*Chloride of Lead*, ↓ and *Acetate of Morphia*.→
	Ammonia.	*Morphia*, ↕ and *Hydrochlorate of Ammonia*.→
	Alkaline Carbonates.	*Carbonate of Morphia*, ↓ and *Chlorides of their Bases*.→
Potassæ Acetas.	Mineral Acids. (*Infus. Rosæ comp.*)	*Sulphate*, or *Nitrate of Potass*, or *Chloride of Potassium*,→ with disengaged *Acetic Acid*. ↑
	Sulphate of Soda.	*Sulphate of Potass*, and *Acetate of Soda*.→
	Sulphate of Magnesia.	*Sulphate of Potass*, and *Acetate of Magnesia*.→
	Tartaric Acid.	*Bitartrate of Potass*, ↓ and *Acetic Acid*. ↑
	Many Metallic and Earthy Salts.	
Potassæ Arsenitis Liquor.	Lime Water.	*Arsenite* and *Carbonate of Lime*, ↓ with *Potass*.→
	Acids.	*Potass Salts* of the acids employed, and Solutions of *Arsenious Acid* in the same acids.

Potassæ Arsenitis Liquor.	Chloride of Calcium.	*Arsenite* and *Carbonate of Lime*, ↓ and *Chloride of Potassium.*→
	Sulphate of Magnesia.	*Sulphate of Potass*,→ and *Arsenite* and *Carbonate of Magnesia.* ↓
	Alum.	*Sulphate of Potass*, and *Arsenite of Alumina.*
	Sulphate of Iron.	*Arsenite of Iron*, ↓ and *Sulphate of Potass.*
	Iodide of Iron.	*Arsenite of Iron*, and *Iodide of Potassium.*
	Nitrate of Silver.	*Arsenite of Silver*, ↓ and *Nitrate of Potass.*→
	Hydrated Sesqui-Oxide of Iron.	*Arsenite of Iron*, ↓ with *Potass.*→
	Infusion and Decoction of Bark.	
Potassæ Bicarbonas.	Nearly similar to the Carbonate, except that it does not precipitate *Sulphate of Magnesia.*	
Potassæ Bitartras.	Lime Water.	*Tartrate of Lime*, ↓ *and Potass.*→
	Ammonia.	*Potassio-Tartrate of Ammonia.*→*
	Acetate of Lead.	*Tartrate of Lead*, ↓ *Acetate of Potass*,→ with *Acetic Acid.*→
	Carbonate of Potass.	*Tartrate of Potass*,→ and *Carbonic Acid.* ↑
	Carbonate of Soda.	*Potassio-Tartrate of Soda*,→ and *Carbonic Acid.* ↑

* A very soluble and laxative salt much used on the continent.

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
POTASSÆ BITARTRAS.	Magnesia.	*Tartrate of Magnesia?* ↓ and *Tartrate of Potass.*→
	Sulphate of Magnesia.	*Sulphate of Potass,*→ and *Bitartrate of Magnesia ?*→
POTASSÆ CARBONAS. (*Decoct. Aloës Comp.*)	Acids.	*Salts of Potass*, with *Carbonic Acid.* ↑
	Metallic Salts.	*Carbonates** of the respective Metals, ↓ with *Salts of Potass.*
	Lime Water.	*Carbonate of Lime,* ↓ and *Solution of Potass.*
	Sulphate of Magnesia.	*Carbonate of Magnesia,* ↓ and *Sulphate of Potass.*→
	Hydrochlorate of Ammonia.	*Chloride of Potassium,*→ and *Carbonate of Ammonia.*→
POTASSÆ CITRAS.	Salts of Lime, Lead, and Silver.	*Citrates* of the respective Bases, ↓ with *Salts of Potass* with the Acids.
	Sulphuric Acid.	*Sulphate of Potass,*→ and *Citric Acid.*→
POTASSÆ NITRAS. *Nitre.*	Alum.	*Sulphate of Potass,*→ with *Nitrate of Alumina.*→

* Except where the metallic base is a Sesquioxide, when the Precipitate will be a Hydrated Oxide.

POTASSÆ NITRAS. *Nitre.*	Sulphate of Magnesia.	*Sulphate of Potass*,→ with *Nitrate of Magnesia.*→
	Metallic Sulphates.	*Sulphate of Potass*,→ with *Nitrates* of the Metallic Oxides.→
	Sulphuric Acid.	*Sulphate of Potass*,→ and *Nitric Acid.* ↑
	Infusum Rosæ Comp.	The Sulphuric Acid is too dilute to effect any decomposition of the Nitre.
*	Hydrochloric Acid. (If heated.)	*Chloride of Potassium*,→ with *Chlorine*, ↑ and *Nitric Oxide.* ↑
POTASSÆ TARTRAS.	All Acids.†	*Bitartrate of Potass*, ↓ and *Salts of Potass* with the respective Acids.→
	Lime Water.	*Tartrate of Lime*, ↓ and *Potass.*→
	Acetate of Lead.	*Tartrate of Lead*, ↓ with *Acetate of Potass.*→
	Nitrate of Silver.	*Tartrate of Silver*, ↓ and *Nitrate of Potass.*→
POTASSÆ SULPHAS.	Tartaric Acid.	*Bitartrate of Potass*, ↓ and *Bisulphate of Potass?*

* *Nitrate of Silver* produces no disturbance in a solution of Nitrate of Potass; nor does the *Sulphate of Soda*, except partially, at the temperature of 32 degrees.

† M. Dive observed, that even Carbonic Acid, when passed in a current through the Tartrate of Potass, by abstracting and uniting with one half of the base, converts it into *Bitartrate;* and he thus explains the formation of *Cream of Tartar* during the ermentation of the grape; accordingly, by mixing the *Tartrate* with fermentable materials, we shall produce this change.

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
Potassæ Sulphas.	Acetate of Lead.	*Sulphate of Lead*, ↓ and *Acetate of Potass.*→
	Nitric Acid.	*Bisulphate of Potass*,→ with *Nitrate of Potass.*→
	Hydrochloric Acid.	*Bisulphate of Potass*,→ with *Chloride of Potassium.*→
	Chloride of Calcium.	*Sulphate of Lime*, ↓ with *Chloride of Potassium.*→
	Bichloride of Mercury.	*No effect.*
	Nitrate of Silver.	*Sulphate of Silver*, ↓ *and Nitrate of Potass.*→
	Sulphate of Magnesia.	Double *Sulphate of Potass and Magnesia.*→
Potassæ Liquor.	Acids and Acidulous Salts.	*Neutral Salts.*
	Earthy and Metallic Salts.	*Neutral Salts of Potass*, and *Hydrated Earths*, ↓ or *Metallic Oxides*, ↓ or *Hydrates.* ↓
	Carbonate of Ammonia.	*Carbonate of Potass*,→ and *Ammonia.* ↑
	Acetate of Ammonia.	*Acetate of Potass*,→ and *Ammonia.* ↑
	Hydrochlorate of Ammonia.	*Chloride of Potassium*,→ *and Ammonia.* ↑

Potassii Iodidum	Starch (*with an acid.*)	*Iodide of Starch.* ↕
	Acetate of Lead.	*Iodide of Lead,* ↓ and *Acetate of Potass.*→
	Bichloride of Mercury.	*Biniodide of Mercury,* ↕ and *Chloride of Potassium.*→
	Tartaric Acid.	*Iodine,* ↓ and *Bitartrate of Potass.* ↓
	Metallic Salts.	*Metallic Iodides,* ↓ and *Salts of Potass.*→
	All Acids, and Acidulous Salts, (except Bitartrate of Potass.)	*Iodine,* ↓ and the respective *Salts of Potass.*
Plumbi Acetas.	Ammonia, and its Carbonate.	*Hydrate,* or *Carbonate of Lead,* ↓ *and Acetate of Ammonia.*→
	Potass, and its Carbonate.	*Hydrate,* or *Carbonate of Lead,* ↓ *and Acetate of Potass.*→
	Tartaric Acid.	*Tartrate of Lead,* ↓ and Acetic Acid. ↑
	Tartrate, and Bitartrate of Potass.	*Tartrate of Lead,* ↓ and *Acetate of Potass,*→ and *Acetic Acid.*→
	Citric Acid.	*Citrate of Lead,* ↓ and Acetic Acid. ↑
	Sulphuric Acid.	*Sulphate of Lead,* ↓ and *Acetic Acid.* ↑
	Alkaline and Metallic Sulphates. Alum.	*Sulphate of Lead,* ↓ and Alkaline or Metallic or *Earthy Acetates.*→

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
PLUMBI ACETAS.	Lime Water.	*Hydrate of Lead*, ↓ and *Acetate of Lime*.→
	Iodide of Potassium.	*Iodide of Lead*, ↓ (*soluble in Potass*,) and *Acetate of Potass*.→
	Tincture of Galls.	*Tanno-gallate of Lead*. ↓
	Infusion of Opium.	*Meconate of Lead*. ↓
	Albuminous Liquids, and various Vegetable Infusions.	*Precipitates*.
PLUMBI DIACETATIS LIQUOR.	Common Water.	*Carbonate*, and *Sulphate of Lead*. ↓
	Solution of Gum.	*Plumbated Gum*.
	Organic Matter.	*Precipitates*.
	Linimentum Saponis.	*Oleate*, and *Margarate of Lead*. ↓
	With other Substances.	The same as with the Acetate.
PLUMBI IODIDUM.	Solution of Potass.	*Plumbo-iodide of Potassium*,→ and *Plumbate of Potass*.
	Sulphuric Acid.	*Sulphate of Lead*, ↓ *Iodine*. ↓

QUERCUS DECOCTUM. *Granati Decoct. Infus. Catechu comp. Infus. Krameriæ. Decoct. Uvæ Ursi. Decoct. Tormentillæ, &c., &c.*	Alkalies, and Alkaline Earths.	*Alkaline*, and *Earthy Tannates.* ↓
	Sesquichloride of Iron.	*Tannate of Iron.* ↓
	Solution of Gelatin.	*Tannate of Gelatin.* ↓
	Potassio-Tartrate of Antimony.	*Tannate of Antimony.* ↓
QUINÆ DISULPHAS.	Tartaric Acid.	*Tartrate of Quina.* ↓
	Tartrate of Potass.	*Tartrate of Quina*, ↓ and *Sulphate of Potass.*→
	Alkalies and their Carbonates, (except the Bicarbonate.)	*Quina*, ↓ and *Alkaline Sulphates.*→
	Lime Water.	*Quina*, ↕ and *Sulphate of Lime.*→
	Infusion of Galls.	*Tannate of Quina*, ↓ * soluble in Acetic Acid.
SAPO, and ALL OFFICINAL LINIMENTS containing it.	Acids.	Separation of the *Stearic*, *Oleic*, and *Margaric Acids;* the added acid forming a salt with the alkaline base of the soap.

* By the action of the air the *Tannate* passes into a soluble *Gallate* (87).

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
SAPO, AND ALL OFFICINAL LINIMENTS containing it.	Earthy Salts, viz. Sulphate of Lime ——— Magnesia Chloride of Calcium Alum Hard Water.	*Stearate*, *Oleate*, and *Margarate of Lime*, ↓ *Magnesia*, ↓ or *Alumina*, ↓ with *Sulphates* of the Alkali.
	Metallic Salts.	*Stearates*, &c., of the respective metallic oxides.
	Lime Water.	*Soap of Lime*, ↓ and the *Alkali* in solution.
SODÆ CARBONAS.	Acids generally.	*Soda Salts* of the respective Acids, → and *Carbonic Acid.* ↑
	Bitartrate of Potass.	*Potassio-Tartrate of Soda*, → (*Rochelle Salt*,) and *Carbonic Acid.* ↑
	Metallic and Earthy Salts.	*Soda Salts* of the respective Acids, → and *Metallic* or *Earthy Carbonates.* ↓
	Lime Water.	*Carbonate of Lime* ↓ *and Soda.* →
SODÆ SULPHAS.	Salts which are precipitated by Sulphuric Acid.	*Sulphates of Lime*, *Lead*, &c. ↓

SODÆ SULPHAS.	Carbonate and Bicarbonate of Potass.	*Carbonate*, and *Bicarbonate of Soda*,→ and *Sulphate of Potass.*→
	Acetate of Potass.	*Acetate of Soda*,→ and *Sulphate of Potass.*→
SODÆ POTASSIO-TARTRAS.	Most Acids and Acidulous Salts, (*except Bitartrate of Potass.*)	*Bitartrate of Potass*, ↓ with a *Salt of Potass*,→ and a *Soda Salt.*→
	Acetate and Diacetate of Lead.	*Tartrate of Lead*, ↓ and *Acetate of Potass* and *Soda.*→
SPIRITUS ÆTHERIS NITRICI.	Sulphate of Iron.	*A deep olive-coloured Solution.*
	Tincture of Guaiac.	A *greenish-blue Coagulum.*
	Alkaline and Earthy Carbonates; (especially if there be excess of Acid.)	*Nitrate* of the Alkalies or Earths,→ and *Carbonic Acid.* ↑
TINCTURÆ. (*Holding Camphor or Resin in solution.*)	Water, and Infusions, and Decoctions.	*Camphor*, or *Resins.* ↓ The latter being soluble in Lime Water and Alkalies, forming *Resinates*, or *Soaps.*
ZINCI OXYDUM.	Potass. Soda. Ammonia.	*Soluble Products.*

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
Zinci Sulphas.	Potass, Soda, and Ammonia.	*Hydrate of Zinc*, ↕ and *Sulphates of the* Alkalies.→
Infusum Anthemidis.	Ammonia. Lime Water, and Carbonate of Potass.	*No Precipitates*, but a modification of colour.
	Sulphuric Acid.	*Copious Precipitate.*
	Nitric and Hydrochloric Acids.	*Precipitates.*
	Phosphoric Acid.	*Considerable Precipitate.*
	Arsenite of Potass.	*No effect.*
	Potassio-Tartrate of Antimony.	*No effect.*
	Perchloride of Iron.	*Dark-coloured Precipitate.*
	Sulphate of Copper.	*Greenish-yellow Precipitate.*
	Nitrate of Silver.	*Turbidness.*
	Bichloride of Mercury.	*No effect.*
	Acetate of Lead.	*Copious yellow Precipitate.*
	Tincture of Galls.	*No effect.*
	Isinglass.	*Turbidness.*

Infusum Armoraciæ Compositum.	Ammonia. Lime Water. Carbonate of Potass. Arsenite of Potass.	*Light greenish-yellow coloured Solution*, without Precipitation.
	Perchloride of Iron.	*Bright red-coloured Solution*, without Precipitation.
	Potassio-Tartrate of Antimony.	*No effect.*
	Isinglass.	*No effect.*
	Sulphuric, Nitric, Hydrochloric, and Phosphoric Acids.	*Precipitates.* ↕
	Sulphate of Copper.	*Slight turbidness*, scarcely visible.
	Nitrate of Silver.	*Precipitation.*
	Bichloride of Mercury.	*Ditto.*
	Acetate of Lead.	*More copious Precipitation than the former.*
	Tincture of Galls.	*Precipitate.*

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
Infusum Caryophylli.	Ammonia. Lime Water. Carbonate of Potass. Arsenite of Potass. Nitric Acid.	*Severally modify the colour, without Precipitation.*
	Sulphuric Acid, Hydrochloric and Phosphoric Acids.	*Turbidness.*
	Potassio-Tartrate of Antimony. Bichloride of Mercury. Tincture of Galls.	*No effect.*
	Sulphate of Copper, and Nitrate of Silver.	*Very slightly turbid.*
	Isinglass.	*Considerable Precipitate.*
	Perchloride of Iron.	*Dark-coloured Precipitate.*
Infusum Calumbæ, and Infusum Cascarillæ.	Ammonia. Lime Water. Carbonate of Potass. Sulphuric Acid.	*No effect.*

Infusum Calumbæ, and Infusum Cascarillæ.	Nitric Acid. Hydrochloric Acid. Phosphoric Acid. Arsenite of Potass. Potassio-Tartrate of Antimony. Perchloride of Iron. Bichloride of Mercury.	*No effect.*
	Nitrate of Silver. Acetate of Lead.	*Turbidness, slight.*
	Isinglass.	*No effect.*
Cinchonæ Infusum, et Decoctum.	Ammonia, Lime Water.	*Quina*, ↕ with *Kinates of* the respective bases.
	Carbonate of Potass.	*Red colour*, but no immediate Precipitate.
	Mineral Acids. Phosphoric Acid.	*No marked effect.*
	Arsenite of Potass.	*Copious Precipitate.*
	Potassio-Tartrate of Antimony.	Considerable Precipitate of *Tannate of Antimony.* ↓
	Bichloride of Mercury.	See *Hydrargyri Bichloridum.*
	Perchloride of Iron.	*No Precipitate, but an olive green colour.*
	Sulphate of Copper.	*No effect.*

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
Cinchonæ Infusum, et Decoctum. *	Nitrate of Silver.	*Very slight turbidity.*
	Acetate of Lead. Tincture of Galls.	*Considerable Precipitates.*
	Gelatin.	*Tannate of Gelatin.* ↓
Infusum Lini Compositum. Decoctum Cydoniæ.	Ammonia. Carbonate of Potass. Arsenite of Potass. Potassio-Tartrate of Antimony. Perchloride of Iron. Isinglass.	*No effect.*
	Lime Water. Bichloride of Mercury.	*A slight Precipitate.*
	Acetate of Lead. Tincture of Galls.	*Considerable Precipitate.*
Infusum Lupuli.	Ammonia. Carbonate of Potass. Mineral Acids. Arsenite of Potass. Potassio-Tartrate of Antimony. Bichloride of Mercury. Tincture of Galls. Isinglass.	*No effect.*

* The bodies ranged as Incompatibles do not indiscriminately affect all barks; but such is their intermixture, as met with in the shops, that it is difficult to enter into farther details. In some cases, *Sulphate of Soda* will throw down from them *Sulphate of Lime.* The Infusion of Pale Bark gives a copious precipitate with *Arsenite of Potass,* while the Decoction of Yellow Bark, farther than having its colour heightened by the alkali, undergoes no change.

Infusum Lupuli.	Lime Water.	*Slight Precipitate.*
	Nitrate of Silver.	*Slight turbidity.*
	Acetate of Lead.	*Considerable Precipitate.*
Infusum Opii.	Ammonia.	*Morphia*, ↕ and *Narcotina*. ↓
	Sesqui-carbonate of Ammonia.	*Morphia*. ↓
	Fixed Alkalies.	*Morphia*. ↕
	Lime Water.	*Morphia*. ↕
	Mineral Acids. Potassio-Tartrate of Antimony.	*No effect.*
	Bichloride of Mercury. Sulphate of Copper. Nitrate of Silver.	*No effect.*
	Acetate of Lead.	*Acetate of Morphia*, → and *Meconate of Lead*, ↓ together with a small quantity of *Sulphate of Lead*, ↓ with colouring matter.
	Arsenite of Potass.	*Considerable Precipitate.*

SUBSTANCES.	INCOMPATIBLES.	RESULTS.
Infusum Opii.	Sulphates of Iron and Zinc.	*Meconates* of those metals with *Sulphate of Morphia.*→
	Astringent Vegetables.	*Tannates of Morphia*, and *Codeia*, ↓ soluble in Acetic Acid. Convertible into soluble *Gallates* by exposure to the air.
Infusum Quassiæ.	Ammonia. Lime-water Carbonate of Potass. The Mineral Acids. Arsenite of Potass. Potassio-Tartrate of Antimony. Perchloride of Iron. Sulphate of Copper.	*No effect.*
	Nitrate of Silver. Acetate of Lead.	*Slight Precipitate.*
	Isinglass.	*No effect.*
Infusum Rhei Compositum.	Ammonia. Carbonate of Potass. Lime Water.	Fine red colour, being a compound of *Rhabarbarin* with the *Alkali.*→

Infusum Rhei Compositum.	Mineral Acids.	*Rhabarbarin.* ↓
	Arsenite of Potass.	*Fine red colour.* →
	Bichloride of Mercury.	*Slight turbidity.*
	Acetate of Lead.	*Considerable Precipitate.*
	Perchloride of Iron.	*Precipitate, dark dirty green.*
	Tincture of Galls.	*No effect.*
	Isinglass.	*Tannate of Gelatin.*

* All the above Infusions, upon which the experiments were made, were carefully prepared with Distilled Water, by Mr. Jacob Bell, to whom the author is much indebted.

ON THE PARTICULAR FORMS OF REMEDIES, AND THE GENERAL PRINCIPLES UPON WHICH THEIR CONSTRUCTION AND ADMINISTRATION ARE TO BE REGULATED.

I. SOLID FORMS.

Pulveres.

551. The form of powder is in many cases the most efficient and eligible mode in which a medicinal substance can be exhibited, more especially under the following circumstances.

1. *Simple Powders.*

552. Whenever a remedy requires the combination of all, or most of its ingredients to ensure its full effects, and its bulk precludes its convenient exhibition in the form of pills, as *Bark*, *Ipecacuanha*, *Jalap*.

553. When medicinal bodies are insoluble. and consequently indisposed to undergo those essential changes, *in transitu*, which render them operative, minute division will place their particles in more immediate contact with the solvent or decomposing powers of the stomach.

554. Gummy bodies that are liable to agglutinate, or those which deliquesce on exposure to the air, do not admit of this form of exhibition.

555. The degree of fineness to which substances should be reduced by pulverization, in order to obtain and preserve their utmost efficacy, is a question of some importance. The im-

palpable form appears to be extremely injurious to some bodies, as to *Cinchona*, *Rhubarb*, *Guaiacum*, and to certain aromatics, in consequence, probably, of an essential part of their substance being dissipated, or changed during the operation. Fabbroni, for instance, found by experiment that cinchona yielded a much larger proportion of soluble extractive when only coarsely powdered. I think it may be received as a general rule, that *extreme pulverization assists the operation of all substances whose active principles are not readily soluble; and that of compound powders whose ingredients require intimate intermixture: whilst it certainly impairs the virtues of such as contain a volatile principle which is easily dissipated, or extractive matter which is readily oxidised.*

556. The mechanical condition of the powder, independent of other circumstances, has been already shown (482) to exert a medicinal influence, and in some cases to be attended with inconvenience; camphor, unless presented to the stomach in a state of minute division, is liable to occasion heat and uneasiness in that organ. (*Fothergill's Med. Observ.*, vol. i. p. 432.) In the external application of a powder, the remark is equally applicable.

557. Powders may be either directed in appropriated doses to be mixed at the time of taking them, as in *Form.* 45, 46, or they may be prescribed in the form of draughts, by the introduction of some viscid medium to ensure their suspension. Both forms have their advantages. In the dry state they may be kept for a much longer period without undergoing any deleterious change; they may also be thus taken in a vehicle most consonant with the taste or caprice of the patient, although in our prescriptions it will be as well to direct the kind of vehicle to be employed, whenever the powder is likely to be decomposed, as would happen were a cretaceous powder to be given in an acid conserve.

2. Compound Powders.

558. The disintegration of a substance is much accelerated

and extended by trituration with other materials; hence the pharmaceutical aphorism of Gaubius, "*Celerior atque facilior succedat composita, quam simplex pulverisatio;*"—thus, several refractory vegetable bodies, as *Myrrh*, *Gamboge*, &c., are easily reduced by triturating them with sugar or a hard gum; and some gum-resins, as *Assafœtida* or *Scammony*, by the addition of a few drops of almond oil. The former Pharmacopœia directed the trituration of aloes with clean white sand, in the process for preparing *Vinum Aloes*, in order to facilitate the pulverization, as well as to prevent the particles of aloes, when moistened by the liquid, from running into masses. Some chemists adopt the same mechanical expedient in preparing the tincture of myrrh. Upon the same principle, in directing a watery infusion of opium, it will be advantageous to advise the previous trituration of the opium with some hard and insoluble substance, so as to prevent such a cohesion of its particles as must repel the due action of the solvent. It is equally evident that, in the construction of composite powders, the addition of an apparently inert ingredient, according to any chemical view of its value, not unfrequently acts a very important part in the combination, in consequence of its action in dividing and comminuting the more active constituents. The *Sulphate of Potass* in the *Compound Powder of Ipecacuan* acts such a part; the *Phosphate of Lime* would appear to perform the same office in the *Antimonial Powder*. In the *Pulvis Jalapæ Compositus*, the bitrartrate of potass greatly increases the activity of the jalap by breaking down its substance, and dividing its particles; and Van Swieten observes that the operation of this resinous purgative is improved by bruising it with sugar, and adding some aromatic. The old combination of "*Pulvis Helvetii*" consisted of alum and dragon's blood, and there can be no doubt but that the effect of this latter ingredient, which has been often adduced as an example of absurdity, was to retard the solution of the alum in the stomach; in consequence of which the preparation was less likely to produce inconvenience, and could,

therefore, be administered in larger doses. The Edinburgh College has substituted kino in their *Pulvis Aluminis Compositus*, which may probably have the same effect in modifying the solubility of the alum. We have analogous instances of modification in the preparations of poisonous compounds; the effects of arsenic were thus found by M. Bertrand to be modified by the admixture of powdered charcoal; and Orfila has proved that by certain mechanical admixtures, arsenic in moderate doses may be entirely deprived of its virulence.

559. In rubbing together different substances, it is necessary to remember that there are many saline bodies which, in the dry state, become moist and even liquid by triture with each other; and that under such circumstances they are susceptible of mutual decomposition (520). This change is effected by the action of water derived from the following sources.

560. 1. *From the Water of Crystallization.* This always operates when the proportion contained in the original crystals is greater than that which the product can dispose of; that is to say, whenever the capacity of the new compound for water is less than that of the original ingredients. By previously driving off the water by heat, we may of course avoid such a source of solution, and no liquefaction and consequently no decomposition can ensue; thus, for example, if recently burnt *Quicklime* be triturated with *Calomel*, the resulting mixture will be white, showing that no decomposition can have taken place, but on the addition of a few drops of water it will instantly assume a dark aspect. If crystallised *Sulphate of Copper* be triturated with *Acetate of Lead*, the resulting mixture will assume a fine green colour; but if the *Sulphate of Copper* be previously heated, and its water of crystallization thus driven off, no change of colour will ensue; if, for *Acetate of Lead*, we substitute *Chloride of Calcium*, and the *Sulphate of Copper* be crystallized, we shall obtain a result of a yellow colour; but if the *Sulphate of Copper* be *anhydrous*, the product will be colourless, becoming, however, instantly yellow,

as in the former case, on the addition of a drop of water, and on a further addition of the same fluid, the yellow product in both instances will be rendered blue, which proves that a chemical decomposition has taken place, and a *Chloride of Copper* resulted, for this salt is rendered *yellow* by a small, and *blue* by a larger, proportion of water. These are instructive instances of the action of the water of crystallization in promoting chemical action between the constituents of saline compounds. The *Cupri Ammonio-sulphas* affords an example, in which its dry ingredients become moist by intermixture, in consequence of the water of the crystals of the *Sulphate of Copper* having been set free. Certain resinous bodies also, as *Myrrh*, become soft or liquid by triture with alkalies, in consequence of the resin and alkali combining so as to form a saponaceous compound, which is immediately dissolved by the water of crystallization thus set at liberty.

561. 2. *From Aqueous Vapour in the Atmosphere.* The water of the atmosphere does not act upon these occasions, unless it be first attracted and absorbed by one of the triturated bodies; e. g. if *Acetate of Lead* and recently burnt *Alum* be triturated together, no change will be produced; but if the burnt alum be previously exposed for a short time to the atmosphere, these bodies will, in that case, become liquid. The instances above related will put the scientific physician in possession of the philosophy of this subject, and enable him to explain phenomena connected with the mutual action of dry bodies upon each other, during the operation of triture; such knowledge will be found highly important, for, without it, he will be often betrayed into the most ridiculous blunders, a glaring instance of which has been already recorded (520).

562. During the exhibition of powders, it is always important to maintain a regularity in the alvine excretions, or an accumulation may take place, attended with very distressing symptoms. Dr. Fothergill relates a case of this kind which succeeded the use of powdered bark; and Mr. E. Brande has communicated a similar instance of mechanical obstruction

produced by the habitual use of magnesia. I could also add, if it were necessary, some striking facts of a similar tendency which occurred from eating bread that had been adulterated with pulverized *felspar*. The precaution seems more particularly necessary in the case of children, whose bowels are readily disturbed by extraneous and insoluble contents. For which reason it is an unsafe practice to administer powdered bark in the erysipelas of infants. I have seen a case in which, after two doses, the child refused the breast, and was not relieved until the bowels had been freely evacuated. It ought also to be generally known that the *sugar-plums* sold to children very commonly consist of plaster of paris; the introduction of such insoluble matter into the stomach must have frequently been an unsuspected source of mischief.

Pilulæ.

563. The most generally convenient and popular of all medicinal forms. They are formed from masses of a consistence sufficient to preserve the globular shape, and yet not so hard as to be of too difficult solution in the alimentary canal. The subject, however trivial it may appear, offers some extremely interesting points of inquiry. The following general observations will enable the practitioner to select those substances to which the form of pill is particularly adapted, and to reject those to which it is not suitable, as well as to direct, *extemporaneously*, the most efficient mode of preparation, with a view to its activity, no less than to the preservation of its active properties.

564. Suitable Substances. 1. All remedies which operate in small doses, as *Metallic Salts*. 2. Those which are designed to act slowly and gradually, as certain *Alteratives*. 3. Such as are too readily soluble when exhibited in other

forms. 4. Substances, the operation of which it is desirable to retard until they have reached the lower intestines, as in certain pills for habitual costiveness. 5. Bodies whose specific gravities are too considerable to allow their suspension in aqueous vehicles. 6. Fœtid substances.

565. Unsuitable Substances. 1. Those which operate only in large doses. 2. Deliquescent, or efflorescent* salts. 3. Bodies of such a consistence as to require a very large proportion of some dry powder to render them sufficiently tenacious, as *Oils*, *Balsams*, &c. 4. Substances so extremely insoluble that, when exhibited in a solid form, they pass unaltered, as certain *Extracts*.†

566. Many substances that are incompatible with each other in solution may be combined in pills, unless, indeed, their medicinal powers are adverse or inconsistent, or their divellent affinities sufficiently powerful to overcome their state of aggregation.

567. Formation into Masses. This is a subject of far greater importance than is usually assigned to it, since *the efficacy of the pill is greatly modified, or even destroyed, by the mechanical condition of its ingredients.* Many substances, as *vegetable extracts*, may be at once formed into pills without any addition; while some dry substances, although separately

* Efflorescent salts, if first deprived of their water of crystallization, may be admissible; but without that precaution the pills will crumble into powder as they become dry.

† This has occurred in my practice with the extract of logwood. Astringent vegetable matter, in combination with iron, is frequently characterised by a hardness not exceeded by ebony, and which is perfectly insoluble. The action of iron upon the petals of the red rose furnishes a very striking instance. If these petals be beaten in an iron mortar for some hours, they will be ultimately converted into a paste of an intensely black hue, which, when rolled into beads and dried, is susceptible of a high polish, still retaining the fragrance of the rose. I have seen a necklace of this description; and I have been informed that the beads form an article of commerce with the Turks, and are imported into Europe through Austria, under the name of "*Rose Beads*," or "*Rose Pearls*."

intractable, react upon each other by triture, and without the addition of any foreign matter, produce appropriate masses; the "*Pilulæ Aloës Compositæ*" offer an instance of this kind; for the extract of gentian, upon being triturated with aloës, yields a soft mass, so that the addition of syrup, as directed by the Pharmacopœia, is not essential. The "*Pilulæ Ferri Compositæ*" also afford another example of the change of consistence produced by the mutual reaction of the ingredients. Many substances, however, cannot be made into pills without some addition, and the materials employed for such an object are technically termed *Excipients.* Such are water, spirit, syrup, mucilage, honey, treacle, conserve of roses, crumb of bread, &c.; the selection of which must have a reference not only to the efficacy, but to the preservation of the mass.

568. When the active elements of a pill are likely to be improved by minute division, a gummy or resinous excipient may be usefully employed; of which the popular pill, known by the name of the "*Dinner Pill,*"* affords a good example; for the *Mastiche*, by dividing the particles of the aloes, modifies the solubility of the mass. The *Pilulæ Opii* formerly consisted of equal proportions of opium and extract of liquorice, and the mass was so insoluble that its effects were extremely uncertain and precarious; under the name of *Pilulæ Saponis Composita*, the practitioner is now presented with a more judicious combination; but in certain cases, where our object is to protract the operation of the opium, we may advantageously modify its solubility by combining it with a gum-resin, or some substance which will have the effect of retarding its solution in the stomach. The *Pilula Styracis Composita* is a compound of this description. I am well acquainted with several magistral formulæ, whose utility has been sanctioned by experience, and I am induced to refer their value to this law of combination. Dr. Young, in his Medical Literature, has observed that the *Balsam of Copaiba* so envelopes metallic salts, as to lessen their activity; he says that the *Sub-car-*

* See note, under the head of purgatives, in the illustrative formulæ.

bonate of Iron, made into pills with copaiba, was given for some weeks without any apparent effect; and that a few hours after the same quantity had been given with gum only, the fæces became perfectly black. An equally striking and instructive proof of the influence of a glutinous or viscid constituent, in wrapping up a metallic salt, and defending the stomach from its action, is presented in the case of Eliza Fenning, who, in her attempt to poison the family of Mr. Turner, of Chancery Lane, by arsenic, providentially administered it in a heavy yeast dumpling.

569. *Water* will on some occasions be found a convenient excipient; powdered *Rhubarb* or *Jalap* may be thus made into masses without any increase in bulk, but the pills, if kept, will be liable to become mouldy. *Syrup* and *Mucilage* may be also employed to impart a convenient consistence, but the pills so composed are apt to become too hard after a few days; this is particularly the case with those containing lead, in which case a *Plumbate* of gum is formed. *Soap* has also its advantages, as well as its disadvantages, as an excipient; it is very eligible for the preparation of substances likely to be injured by the acidity of the stomach; it is also convenient for reducing several resinous bodies, as *Camboge*, *Aloes*, &c., to a suitable consistence, although in prescribing it, its levity should be attended to, or otherwise the pills would be too bulky; in general it will combine with an equal portion of any resinous powder; but it will be more expedient to compensate a portion of the requisite quantity by the addition of some syrup, as exemplified in several of our officinal pills. It is necessarily ineligible in cases wherein the ingredients are decomposed by alkalies, as *Potassio-tartrate of Antimony*, &c.

570. *Conserve of Red Roses* is a valuable excipient, as it retains its consistency much longer than mucilage or syrup; according to the experiments of Mr. Cheyne, of Edinburgh, which have been verified by Dr. Christison, it appears that in the quality of preserving pills sufficiently soft, no other excipient equals this conserve; a property which would

appear to depend upon its capability of retaining a certain quantity of moisture, for a long period; since, however, it contains an uncombined acid, it cannot be employed with propriety with the *Oxysulphuret of Antimony*.

571. *Treacle* is also an excipient of great value for forming active vegetable powders into pills, such as *Digitalis*, *Conium*, &c. It does not undergo any change by time, but maintains a proper consistence, and preserves the properties of the plant unimpaired for many years.

572. *Crumb of Bread* furnishes a convenient vehicle for those salts which are ponderous, active in very small doses, or which are liable to be decomposed by other excipients; but an objection is attached even to this, for it is liable to become so dry and hard when kept, that pills made with it will frequently pass through the bowels undissolved. Swediaur mentions this fact with respect to *Plenck's Mercurial Pill*, as well as with one of corrosive sublimate, and he proposes for this reason to substitute *Starch*; the addition, however, of a small portion of sugar will obviate the objection, and with such a precaution it may be safely employed; but we must remember that, as bread always contains chloride of sodium, it may decompose certain salts, as the *Nitrate of Silver*.

573. *Rectified Spirit* will often afford a convenient excipient for keeping resinous matter soft; and Dr. Christison observes that for reducing the compound colocynth pill mass to its due degree of softness, it answers extremely well, since it is strongly retained in small quantity by the resinous ingredients.

574. *Castor Oil*, in some cases, especially with the harder purgative extracts, will impart an eligible consistence.

575. The addition of a small quantity of some deliquescent neutral salt, such as the acetate of potass, will, according to Mr. Cheyne, be useful in retaining a pill mass in a suitable condition of moisture. It is introduced for such an object in the *Pil. Rhei* E.

576. In the preparation of pill masses, the ingredients

should be hastily rubbed together, whenever they are liable to be injured by exposure to the air; thus in the preparation of the *Pil. Hydrarg. Chlorid. co.* the compound is rendered less active by too long continued trituration.

577. In dividing masses into pills, it is usual to add to them, and to envelope them in, liquorice powder, wheat starch, or magnesia, in order to prevent them from adhering together. In Germany the pulverulent seed of the *Lycopodium Clavatum* is generally used as an involucrum. In former times the pill was usually covered with gold or silver leaf, in order to deprive it of taste, but which at the same time protected it from the solvent action of the stomach, and frequently rendered it unavailing. With respect to the employment of magnesia upon these occasions, I have satisfied myself by experiment that, when calomel is present, a *Muriate of Magnesia* is formed in consequence of the decomposition of the mercurial salt; and it is owing to this chemical action that the surface of the pill exhibits a greenish hue. There is also, in some cases, an objection to the powder of liquorice, as it is liable to irritate the fauces and occasion cough; for which reason I frequently give a special direction for the use of starch. (*Form.* 19.)

578. In our extemporaneous directions, it is necessary to apportion with accuracy the quantity of active materials which we may wish each pill to contain; and since the proportion of the *excipient* can seldom be accurately defined, the equable division of the whole mass into a given number of pills, will be safer than defining the weight of each pill.

579. A pill, the bulk of whose ingredients consists of vegetable matter, ought not to exceed five grains in weight; but where the substances which compose it are metallic and ponderous, it may without inconvenience weigh six, or even eight grains.

Trochisci—*Lozenges.*

580. Since these are regarded as objects rather of confectionary than of pharmacy, the London and Dublin Colleges have not thought it necessary to notice them; the Edinburgh Pharmacopœia, however, contains several useful formulæ for their preparation; and since the form of lozenge offers a commodious and efficacious method of administering certain remedies, the theory of its operation deserves some notice in this place.

581. It is principally useful in cases wherein it is an object that the remedy should pass *gradually* into the stomach, in order to act as powerfully as possible upon the pharynx, and top of the trachea, as in certain expectorants, demulcents, or astringents; *Nitre*, for instance, when intended to operate in relaxed or inflamed states of the tonsils, will be best applied in this manner; so will *Sulphate of Zinc* in chronic coughs, attended with inordinate secretion.

582. In order to retard as long as possible the solution of the lozenge, it ought to be composed of *several* demulcent substances, such as farinaceous matter, sugar, gum, and isinglass; for such a mixture will be found to answer the purpose better than any one of these articles taken by itself; thus the farinaceous matter will prevent the sugar and the gum from being too soon dissolved; the viscidity of the gum will prevent the farinaceous matter from being swallowed so soon as it would otherwise be; and the isinglass will give a softness to the whole, and thus prevent any sharp points from stimulating the membranes. Lozenges also produce relief by a mechanical mode of operation which has never been understood. They unquestionably increase the flow of saliva, and thus keep the throat in a state of moisture. I am acquainted with a person who, during the attacks of cough to which he is liable, always experiences relief by sucking a small pebble.

Electuaria.

583. This is an ancient form of prescription; for although the term "*Electarium*" is first used by Cælius Aurelianus, yet the ἔκλικτον of Hippocrates, and the *Antidotus*, *Confectio*, *Mithridatium*, *Dioscordium*, *Opiatum*, *Orvietanum*, *Philonium*, *Theriaca*, and *Requies* of other authors, were all electuaries; and though modern science has dismissed a number of these galenical preparations as cumbrous, still it is occasionally useful in modern practice, as it enables the physician to administer a large quantity of a powder or extract in the least unpleasant form. (*Form.* 36, 105, 106, 119, 130, 176, *e quibus usus sponte patet.*

584. Electuaries differ from *Conserves* in the less proportion of their sugar, and in the object for which it is introduced; in the latter it is merely intended to *preserve* the ingredients, whereas in the former its purpose is to impart convenience of form. The London College now comprehends under the title of *Confections*, the conserves and electuaries of its former pharmacopœias.

585. The name of electuary, however, is still retained in extemporaneous prescriptions. It is usually composed of dry powder, formed into a proper consistence by the addition of syrup, honey, mucilage, or conserve of roses; when mucilage is employed, the electuary very soon becomes dry and hard; and when common syrup is used, the mass is apt to candy, and in a day or two to grow too hard for use; this is owing to the crystallization of the sugar. Deyeux therefore states, that the syrup should be previously exposed to the heat of a stove so long as it forms any crystals, and that the residual liquor, which has no tendency to crystallization, may then be advantageously applied. *Molasses*, or *Treacle*, may in some cases be employed, and from experiments which I formerly repeated, I can state that the peculiar flavour of that substance may be entirely removed by diluting it with an equal weight of water, and then boiling it with about one eighth part of

powdered charcoal for half an hour, when the liquor is to be strained, and reduced by gentle evaporation to a proper consistence; and it may be as well to remind the practitioner that active vegetable powders retain their characteristic qualities when immersed in treacle longer than in any other excipient.

586. In selecting and prescribing this form of exhibition, the following general rules should be observed.

I. *Those substances which are nauseous, deliquescent, or which are incapable of forming an intimate union with syrup, as fixed oils, balsams, &c., should never be prescribed in this form.*

II. *The proportion of the Excipient must be regulated by the nature and specific gravities of the substances which enter its composition, e. g.*

1. Dry vegetable powders require twice their weight of syrup or honey.
2. Gummy and resinous powders, an equal weight.
3. Hard mineral substances should be formed into an electuary with some conserve, since they are too ponderous to remain suspended in syrup. Saccharine matter, however, is always to be preferred to mucilage, on account of its conservative virtue, as already fully explained (491).

587. In apportioning the dose of an electuary, unless a single one be directed, it is usual to refer to a standard of bulk rather than to one of weight, viz. *ad nucis avellanæ, juglandis, castaneæ, magnitudinem; vel instar nucis moschatæ; aut quantum cochleari mediocri capi, vel cultri apice attolli, possit.* Should the quantity to be taken be more considerable, we

may direct generally, *Tantum sumat quantum sine fastidio ferri possit:* or, *partitis dosibus donec totum assumptum fuerit.*

Linctus. *Eclegma, Looh.*

588. A *Linctus* differs principally from an electuary in being more liquid, and from a syrup in being of a thicker consistence. Its chief value consists in being from to time introduced into the mouth, and gradually swallowed, by which the local influence of the medicine is protracted. In coughs, hoarseness, relaxed or sore throat, and other similar affections, its operation is obvious. (*Form.* 147, 182.)

Suppositoria.

589. This is an ancient form of preparation, and although of late years it has fallen into comparative disuse, it affords a very efficacious mode of administering many powerful medicines; and in some instances of producing effects which the same remedy, if given in any other form, would not be able to command; besides which, it is found that after the stomach by long use has lost its susceptibility, the same substance will operate with fresh and unabated force if applied to the rectum. There are two great indications which *Suppositories* are calculated to fulfil.

590. 1. *The alleviation of pain and irritation,* especially when it arises from diseases of the bladder, prostate gland, uterus, and other parts in the vicinity; in which cases the efficacy of the remedy would appear to be greatly promoted by the sympathy of contiguity. In my own practice I have known a violent sciatica cured by it; and nothing will give greater relief in those harassing pains and distressing subsultus which frequently accompany certain cases of paraplegia. Abortion may also be thus frequently prevented. To fulfil

these indications, a mixture of one part of opium and two parts of soap will be found eligible; or in some cases a mixture of belladonna will be useful.

591. 2. *The production of Catharsis.* In cases of apoplexy, and insensibility from other causes, the counter-irritation which these remedies are likely to occasion, may be productive of benefit; and in the failure of the more ordinary remedies, they will hold out a fair promise of success in the cure of *Ascarides.* (*Form.* 181.) Where a very efficient suppository is required, one or two grains of *Elaterium* rubbed up with eight grains of hard soap, will present us with a combination of great utility.

592. For the easy introduction of the suppository, small tubes may be obtained at any of the instrument makers; and upon some occasions it may be useful to smear the surface of the suppository with a little almond or castor oil.

II. LIQUID FORMS.

Misturæ.

593. The term *Mixture* is at present applied to those preparations in which different ingredients are mingled together in the liquid form, or in which solid substances are diffused through liquids, and suspended in them by the medium of mucilage or syrup. It consequently includes those subordinate forms which were distinguished by the older writers by the terms, *Emulsions*, *Julaps*, &c.

594. In prescribing extemporaneous mixtures, the following general rules must be observed.

I. Substances which are disposed to enter into chemical union, or to decompose each other, ought not to be mixed together, unless it be with a view to obtain the new products as a remedy.

II. Transparency is not a necessary condition, and hence insoluble powders may be introduced into a mixture, provided that the following precautions be observed.

1. They must be divisible, and mechanically diffusible in the liquid.
2. They must not possess too great a specific gravity.
3. They must not render the liquid too mucilaginous or thick; thus f℥j *should seldom hold suspended more than* ʒss *of a vegetable powder,* ℈ij *of an electuary and conserve, or* ℈j *of an extract.*

III. The taste, the odour, and the general aspect of the mixture should be rendered as agreeable as possible.

595. The physician may also produce occasional changes in the appearance of his mixture, in order to reconcile a delicate taste to its continuance; but he never ought to alter the essential part of a plan which he finds advantageous. This, however, is an error into which every young practitioner is too liable to be betrayed; impatience and adventure are the characteristics of youth; and should a medicine not quickly produce all the anticipated advantages, it is abandoned for others, which in their turn are as readily dismissed as useless. In short, he treats his patient as a boy does his first watch, by putting him backwards and forwards for experiment sake. While I am writing, how many instances of this kind are recalled to my recollection, when thirty years ago I was physician to the Westminster Hospital!

596. A Draught differs merely from a Mixture as to quantity; it is usually taken at once, and should not exceed f℥iss. It is to be preferred to a mixture when

1. *The remedy is to be taken in a precise dose.*
2. *Whenever it is readily liable to spontaneous decomposition, or to be speedily affected by the action of the air.*

597. In apportioning the dose of a mixture, the following proportions may be considered as sufficiently accurate approximations. A TABLE SPOONFUL, (*Cochleare Amplum,*) f℥ss; DESSERT SPOON, (*Cochl. Mediocre,*) f℥ij; teaspoon, (*Cochl. Minimum,*) f℥i; a wine glass, (*Cyathus,*) although very variable, may be estimated as f℥iss. The custom of measuring the dose of a liquid by dropping it from the mouth of a phial is necessarily very inaccurate, and since the force of cohesion varies in different liquids, as it does in solids, the size of their respective drops must vary accordingly. It will, therefore, be always advisable to dilute an active medicine that is to be so apportioned, with at least a treble quantity of water or spirit, that its real dose may not be essentially altered by any slight alteration in the quantity.

598. The temperature at which a liquid medicine should be given, may perhaps deserve some notice. In general the ordinary degree of heat is that best calculated to answer our purpose; but in cases of dyspepsia I have frequently found that the sense of weight and uneasiness which are liable to follow a dose, may be prevented by giving the medicine in a tepid state. In delicate chlorotic females, chalybeate draughts are not only more efficacious, but less likely to disagree when thus administered. The necessary temperature may be imparted to it by placing the phial containing it in hot water for a short time before it is taken.

ENEMATA.

599. This form furnishes the practitioner with many valuable resources, although in former times it had not escaped

its share of reproach. Paracelsus bestowed upon it the epithet, "*Turpissimum Medicamentum*," and Van Helmont that of "*Pudendum Medicorum Subsidium*." The College, in their last Pharmacopœia, have introduced several formulæ for their preparation, viz. *Enema Aloës;* E. *Colocynthidis*—E. *Opii*—E. *Tabaci*—E. *Terebinthinæ*. They are calculated to fulfil the following indications.

1. *To promote the tardy operation of a Cathartic; or to evacuate the bowels, where, from irritability of stomach, medicines cannot be retained, or from debility of body they cannot be safely administered.*

600. There are two essential circumstances, independent of the ingredients, which will modify the activity of a clyster, *viz.* IMPULSE and QUANTITY, by which we obtain the stimulus of impression, as well as that of distension. Where our object is free evacuation, not less than a pint of liquid should be thrown up; warm water alone may be thus made the means of overcoming an obstruction which more active measures had failed to remove. The addition of *Soap* not only increases its effect, but may neutralize an irritating acid which commonly exists in the lower bowels of dyspeptic subjects. By giving an *impulse* or *momentum* to the injected liquid, the local impression is so powerful that, although it cannot reach beyond the sigmoid flexure of the colon, its influence will extend, by the medium of sympathy, through the whole alimentary canal, so as to produce a thorough and copious discharge.

2. *To produce Astringent, Anodyne, or Carminative Effects.*

601. The *Enema Opii* of the Pharmacopœia is probably the best form; the quantity of opium can be regulated according to circumstances; it offers the advantage of influencing the system by a narcotic, without the inconvenience of disturbing the functions of the stomach; and in certain spasmodic affections of the bowels, bladder, and uterus, or of the

lower extremities, and during the passage of a calculus along the ureter, it derives additional power from the sympathy of contiguity. In some cases the injection of *cold water* acts as a powerful astringent, and from its impression upon the rectum will frequently afford instantaneous relief in hemorrhoidal affections. As a *Carminative*, in tympanitis from collapse, as in the ulterior stage of fever, according to my experience a drachm or two of the *Confectio Rutæ*, rubbed up with three or four ounces of gruel, affords a most efficacious clyster.

3. *To induce extreme Relaxation.*

602. In cases of obstinate constipation, depending upon violent spasmodic constriction, in *Ileus*, or incarcerated *Hernia*, clysters of tobacco have produced speedy relief; but the practice is not unfrequently attended with vomiting, extreme debility, and cold sweats, circumstances which render it highly dangerous in cases wherein the patient has been already exhausted by protracted suffering. I witnessed some years ago a lamentable instance of this kind; a medical practitioner, after repeated attempts to reduce a hernia, injected an infusion of tobacco, and shortly afterwards removed the patient in a carriage to the Westminster Hospital, for the purpose of undergoing the operation; but the unfortunate man arrived only a few minutes before he expired. Tobacco clysters were some years since recommended in America for the purpose of forwarding difficult parturition, but the alarming symptoms which followed in the only case in which it was tried, prevented a repetition of the experiment. They were also formerly proposed for recovering persons in a state of *asphyxia:* it is not easy to conjecture how such an idea could have occurred to any rational physiologist. Any quantity of infusion containing more than half a drachm cannot be injected without danger, and should the clyster not come away in a few minutes, tepid water should be thrown up to favour its return.

4. *To act as an emollient Fomentation.*

603. For this purpose, gruel, starch, and other demulcent infusions may be employed.

5. *To destroy Ascarides.*

I have already considered this subject; (349;) see also *Form.* 180.

6. *To convey Nutriment.*

604. Strong broths, beef-tea, &c., thickened with arrow-root, furnish the most appropriate fluids, with the addition, if necessary, of some laudanum to ensure its retention.

605. For the accomplishment of any of the above last five indications, it is obvious that the stimuli of impulse and quantity should be avoided; to prevent the opiate clyster from returning, its bulk should not exceed three or four ounces. In administering a bitter decoction for the cure of ascarides, the same precaution is necessary, or the gut will suddenly contract and expel it; this should be avoided, as the clyster will act with more certainty when allowed to remain for some time; after its return, a common injection of salt and water, in a greater quantity, may be sent up to wash out the intestine.

Injectiones.

606. Under this head may be comprehended the various medicinal preparations which are employed locally, to the urethra for the cure of gonorrhœa, and to the vagina, for that of the different discharges to which females are liable.

607. With respect to the former of these, it has been truly observed, that "among the whole class of remedies employed for surgical purposes, there is scarcely one that has occasioned a greater diversity of opinion;" to enter, however, into an

examination of this question would be entirely foreign to the intention of the present work; it is only necessary to state that, for their preparation, the same principles of combination, and the same chemical precautions apply, as for those which have been already investigated. In some cases the practitioner will find it useful to ensure the entire solution of his active ingredient, while in others the presence of a precipitate may enhance its efficacy. (480.) See *Form.* 65.

608. In the preparation of injections for female discharges, it must be remembered that, if they be of a vegetable nature, their efficacy will probably depend upon *Tannic Acid*, and the prescriber must therefore take care not to invalidate the power of this principle by incompatible additions; it also deserves notice that as tannic acid has the power of coagulating animal mucus, and of forming with it an insoluble compound, its administration, as an injection, is liable to occasion the evacuation of whitish, or ash-coloured flakes, which will come away from time to time, and excite in the patient's mind, says Sir Charles Clarke, the apprehension that she is voiding portions of the internal parts of the body, unless she be prepared for the occurrence by a previous explanation, and which the judicious practitioner will not neglect to afford. In some cases it will be necessary to correct the irritating effect of the astringent, by the addition of a demulcent, as exemplified in *Form.* 69. In applying this form of remedy, an ivory syringe should be always preferred to one of pewter, whenever the solution is likely to be affected by the contact of a metal. Dr. Ashwell, in his recent work on "Diseases peculiar to Women," states that he has discontinued the use of the syringes for vaginal injections, as he finds india-rubber bottles, fitted with ivory tubes, less liable to get out of repair, and at the same time more manageable. The same practical author has furnished us with many useful directions as to their administration; in cases of susceptible and irritable women, it is often necessary to apply the injections warm, so as to prevent the occurrence of the spasmodic pain which has followed their use when cold.

Inhalationes.

609. Under this general title are comprehended two distinct species, *viz.* dry fumes (*Suffitus*) and watery vapours (*Halitus*).

610. With respect to this particular form of remedy, it may be observed that, if the power of a medicine be so greatly modified by circumstances affecting its solubility, it is fair to infer that the still further diminution of its cohesion may occasion a corresponding influence upon its energies; indeed, it would appear that some few substances* are entirely inert under any other form. The operation of inhalation, moreover, enables us to bring various bodies into immediate contact with organs exposing a great extent of mucous surface, through which innumerable capillaries spread out their ramifications, and to which all remedies, in any other state of aggregation, are necessarily inaccessible. This observation applies more particularly to the lungs and their air-passages.

611. The practice of causing patients to inhale various volatilized substances is of ancient date. Galen recommended the fumes of *Orpiment* to be breathed; but few attempts of the kind had been made until the time of our countryman Bennet, the author of the "*Theatrum Tabidorum*," who arranges volatilized substances under the two divisions which have been announced at the head of the present section, *viz.* *Suffitus* and *Halitus*. Sir Alexander Crichton published, in the year 1823, a pamphlet on the effects of the vapour of boiling tar in the treatment of pulmonary disease, which recalled the attention of the profession to a practice that had entirely fallen into neglect, in consequence, no doubt, of the

* Metallic mercury affords a good example; although inactive in its fluid form, it is highly active in the state of vapour; it is thus that the workmen employed in gilding, silvering looking-glasses, constructing barometers, &c., experience such dreadful effects, for the metal assumes an elastic form at the ordinary temperature of the atmosphere, as Mr. Faraday has proved by a series of conclusive experiments.

injudicious and empirical spirit with which it had been pursued. More recently, Dr. Harwood, of Saint Leonard's, has published a very sensible and practical essay on the use of inhalations, the effect of which has been to revive the practice. He has pointed out several important precautions which should be observed in conducting the process; he has shown that a vapour at a temperature above that of the human body may be injurious; that, unless a proper apparatus be employed, and the patient be properly directed in its use, the muscular powers are exhausted by the prolonged efforts of suction, whereas the invalid should always endeavour to conduct the process as much like ordinary breathing as possible, or in other words, without effort or fatigue. To ensure these objects, Dr. Harwood has constructed an inhaler, which appears to me to have realized all the expectations it has raised.

612. Suffitus. *Fumes of Burning Substances.* At the request of Sir Alexander Crichton, I tried the tar fumigation in several chronic cases of bronchitis, which were accompanied with a general relaxed state of the system, with very considerable success. To every pound of tar half an ounce of carbonate of potass was added, to neutralize the acetic acid present in it. It was then placed in a basin over a lamp, and kept slowly boiling in the chamber in which the patient was confined. In the present day a few drops of *Creosote* are added to a thin mucilaginous solution, and breathed from the inhaler. Various balsamic remedies* have been introduced for a similar object; since, however, these all act as stimu-

* Dr. Mudge, in the year 1782, had recommended the fumigation of balsams in a pamphlet on the subject of his inhaler; little or no notice, however, was taken of it, a circumstance which cannot excite our surprise when we consider the extravagant terms in which the pretensions of the remedy were supported. "I believe," says he, "that much of the benefit which consumptive patients experience from sea voyages is derived from the tar vapour constantly present on board a ship!" *A Radical and Expeditious Cure for a recent Catarrhous Cough. By J. Mudge, Plymouth,* 1783.

lants, the practice cannot be considered free from danger where an inflammatory diathesis prevails, or any tendency to hæmoptysis exists. The *Sulphuret of Mercury* has also been employed as a fumigation, by throwing ʒss of it on red-hot iron, and cautiously inhaling the fumes; the effect is generally speedy salivation. Mr. Pearson observes that it is useful in those cases of venereal ulcers in the mouth, throat, and nose where it is an object to put a sudden stop to the progress of the disease. Ulcers about the pudenda and anus are also much benefited by it; in which cases it is conveniently applied by placing a red-hot heater at the bottom of a night-pan, and after sprinkling upon it a few grains of the *Sulphuret*, placing the patient upon the stool. The *Sulphuret* is of course decomposed, and *Metallic* mercury, together with a portion of sulphureous vapour, are volatilized.

613. The practice of smoking the roots of stramonium, tobacco, and other narcotics, may with propriety be noticed under this head. Dr. Harwood has drawn a nice physiological distinction between the acts of inhalation and smoking. "In this latter case, the smoke does not pass into the trachea, in consequence of the then closed state of the valves of the throat; and so admirable is the protection afforded to the lungs by these means, that although the smoke taken into the mouth be permitted to traverse the pharynx, and even to return through the nostrils, by the elevation and depression of the velum, yet the perfect valve, formed by the epiglottis, still prevents its entering the trachea." The beneficial effects, therefore, occasionally derived from smoking *Stramonium* in spasmodic dyspnœa, must be the result of sympathy, communicated by the nerves, from the throat and fauces to the ramifications of the air-tubes.

614. *Halitus.* This division embraces a wider and more important class of remedies. We may commence with the objects to be fulfilled by simple water in the form of steam. I have upon a former occasion stated the advantages that, in certain dry conditions of the atmosphere, may be derived from

evaporating water in the apartment of a patient. (174.) I shall only observe in this place, that the profession do not appear to attach sufficient importance to it; not only is a certain degree of moisture in the air essential to healthy respiration, but it would appear, when in too dry a state, to act as an irritant to the bronchial tubes. In states of congestion nothing is more calculated to soothe their mucous membrane than the inhalation of steam; to which may be added such medicines as appear appropriate to each particular case. *Formula* 29 is one which I am constantly in the habit of prescribing with much benefit in highly irritable coughs. In certain catarrhal affections, when accompanied with difficult expectoration, the addition of a small quantity of vinegar will often be found useful, the acid in this case assisting the expectoration, while the whole acts as an emollient and soothing application to the tender and irritated vessels of the internal surface of the bronchial tubes. The same practice is also highly serviceable in *Cynanche Trachealis* and *Tonsillaris*. In pneumonia, after the violence of the arterial excitement has been reduced by depletory measures, the inhalation of the steam of hot water, or decoctions of emollient herbs, taking care that the temperature be moderate, will often contribute to the support of an easy expectoration. In dyspnœa, attended with a spasmodic constriction, vapours impregnated with *Sulphuric Æther* have been recommended for inhalation. Dr. Pearson also states that the efficacy of such an application is materially enhanced by dissolving in it a portion of the *Extract of Conium*. Dr. Böotcher, of Copenhagen, has announced the utility of vapours of *Camphor* in complaints affecting the cavities of the nose, throat, and chest. He states that in the worst case of stoppage of the nose from catarrh, a piece of camphor need only to be kept for a few minutes before it, to obtain great relief; the same application has been known to produce good in cynanche tonsillaris. Various other substances, as *Iodine*, *Chlorine*, &c., in pulmonary consumption, have been recommended, but not having much con-

fidence in their powers, I have had no experience of their effects.

REMEDIES OF EXTERNAL APPLICATION.

615. This class of medicinal agents formerly composed a much wider range of forms; such as numerous *Epithems, Aromatic bags, Medicated Quilts and Pillows,** &c. The external applications of the present day are *Cataplasmata, Cerata, Emplastra, Linimenta, Lotiones,* and *Unguenta;* to which may be added the different forms of the bath. They may be physiologically arranged under two classes, *viz.*

1. *Those, the effects of which are entirely* LOCAL, *as exemplified in the application of certain Lotions, Cataplasms, Plasters, and Ointments.*
2. *Those which excite general effects, or produce an influence upon parts remote from the seat of application,* as in the case of *Blisters* and other *Counter-irritants;* and of *Mercurial Ointments, Liniments, and Plasters, and Hot and Cold baths.*

616. In this latter category we may also include the general tonic effects of adhesive plasters and bandages. To what extent a medicinal substance, when locally applied to the surface of the body, may be capable of affecting the general system, or some of its remote parts, is a question that has

* *Quilts* stuffed with *Bark* have been recommended in fevers. The *Hop-pillow* (*Pulvinar Humuli*) has been long employed for producing sleep. Dr. Willis brought it into vogue by prescribing it for George III. Van Swieten states that pillows of the *Male Fern* were once in great repute for the cure of *Rachitis.*

excited much discussion. The subject has already been brought before the reader in the present work, (14 and 46,) and it would thus appear that topical applications may produce general effects by several distinct modes of operation, *viz.*

1. *By exciting an impression on the nervous system,* as evinced in the operation of the Cold Bath, and counter-irritating applications.
2. *By modifying the Cuticular discharge.* The Vapour Bath derives its value from such an effect. (330.)
3. *By being absorbed into the circulation.*

61J. In considering the different forms of external application, it will appear that, for their extemporaneous construction, preparation, and application, the same scientific knowledge, practical skill, and pathological acumen, will be required, as we have already stated to be so indispensably requisite to enable the physician to prescribe, and the pharmaceutist to prepare, the various remedies intended for internal administration. A series of *Formulæ* are given in the Pharmacopœia, but the practitioner will constantly find it necessary to extend their usefulness, or to modify their powers, by extemporaneous additions; and for this he will necessarily require a competent share of chemical knowledge.

Emplastra.

618. These are solid and tenacious compounds, adhesive at the ordinary heat of the body. They owe their consistency to different mechanical and chemical effects, *viz.*

1, *To the chemical combination of the Oxide of Lead with one or more of the oily acids.*

619. In scientific strictness, the term *Plaster* should be exclusively applied to compounds of this kind. Although the *Lead Plaster* was known to the ancients, and the formula for

its preparation, as given both by Pliny and Celsus, differs very little from that of a modern Pharmacopœia, its composition remained unknown until the masterly researches of Chevreul put us in possession of the true chemical nature of oils and fats, which were proved by this distinguished philosopher to be, in reality, SALTS, consisting of certain organic acids, in combination with the *Oxide of Glycerule*, (*Glycerine*, the sugar of oils,) as a base. These acids received the names of the *Stearic*, *Margaric*, and *Oleic* acids; and the relative fluidity or consistence of the oil or fat was found to depend upon the predominance of one or other of these acids in its composition. The terms *Stearine*, *Margarine*, and *Oleine*, as being more laconic, are employed to express respectively the *Stearate*, *Margarate*, and *Oleate* of the oxide of glycerule. We have thus a key to discover the nature of the different compounds which oils and fats form with different bodies, and the changes they undergo by different reagents. If acted upon by alkalies, or by the oxide of lead, a decomposition takes place; in the one case there will result a stearate, margarate, and oleate of potass or soda, (*Soap*,) in the other a combination of these acids with the oxide of lead, forming an insoluble *Plaster;* while in both cases the oxide of glycerule will be separated, and by uniting with the water, will become hydrated oxide of glycerule, (glycerine, or sugar of oils.) Berzelius considers the *Emplastrum Plumbi* as a tribasic salt, or in other words, as a compound of one equivalent of the oily acids, and three of the oxide of lead.

620. In turning to the Pharmacopœia, we shall find that the *Lead Plaster** forms the basis of most of the plasters in common use; in combination with resin (*Emplast, Resinæ*) it constitutes the common *Adhesive Plaster;* different prac-

* This plaster is usually sold under the name of *Diachylon,* which signifies prepared from juices, δια et χυλος. It has been said that all the pharmaceutical names to which *Dia* is affixed are of Arabian origin; but this, however, is not the case; we frequently meet with examples in Galen, η δια δικταμυου, η δια δυολν αριστολοχιολν, η δι, &c.

titioners, however, are in the habit of varying the proportion of resin, and they accordingly obtain a plaster of different qualities. The effect of the resin is to render it more adhesive, but at the same time it renders it more irritant; so that in many cases excoriations are produced by its application. For this reason, Baynton's adhesive plaster (*Strapping*) contains less resin; there being only six drachms, instead of two ounces, to a pound of the lead plaster. In some cases *Soap* may be added to the combination, more particularly when the *Emplast. Saponis*, which consists only of soap and lead plaster, is not sufficiently adhesive; in this way, by extemporaneous modifications, we may obtain a plaster of any desired quality as to adhesiveness.

2. *To a due Admixture of Wax or Fat, and Resin.*

621. These compounds, although now designated as plasters, may be said to differ only from liniments, ointments, and cerates, in the degree of consistence, e. g. *Emplast. Ceræ;* Deyeux, therefore, proposed to distinguish them by the appellation of *Solid Ointments.* Being mild and tractable, they may be usefully employed as the excipients of active substances. e. g. *Emplast. Cantharidis.*

3. *To the Chemical Action of the Component Parts of the Plaster on each other*, as exemplified in the *Emplast. Ammoniaci.*

622. Officinal plasters are generally kept in rolls, and when to be used, they are melted and spread upon soft leather; in performing this operation, heat above that of boiling water ought not to be applied, for if a metallic oxide be present it may be reduced, and should aromatic or volatile substances enter as ingredients they will be thus dissipated; besides which, the oily matter itself will undergo a very injurious change by a mismanaged application of heat, and the plaster will be less adhesive.

623. They are employed as remedies to answer two general indications; *mechanically*, to protect an excoriated part, to afford support to weak muscular structures, and to exclude the access of the air; and *medicinally*, to operate as stimulant, discutient, rubefacient, alterative, anodyne, and antispasmodic applications.

624. That by affording artificial support to various parts of the body, by the application of plasters, and other mechanical contrivances, we are capable of affording great relief in many diseases, is a truth to be explained upon the soundest views of physiology, and is daily confirmed by the results of practice; thus, by giving support to the muscles of the back, how frequently is the stomach steadied and strengthened! Diseases of the kidneys are in the same way very frequently relieved by tight bandages around the loins; the existence of an intimate connexion between the external and internal parts is strikingly exemplified by the distressing effects which are often experienced in weak habits, such as sickness, giddiness, and other uneasy sensations, from the removal of any accustomed compression, as that from stays, under-waistcoats, &c. It is also shown by the increased vigour produced by swathing and lacing where debility occurs from relaxation of the fibres. The support afforded to persons who have been tapped in ascites is another instance. I have also met with many cases, in the course of my practice, in which a morbidly relaxed state of the bowels having harassed the patient for several years, and set at defiance the ordinary methods of treatment, has been cured by the application of a bandage, or elastic belt around the abdomen. In recommending, however, such a practice, I ought not to pass over unnoticed the mischief its abuse may occasion; there is a limit to this sanatory pressure; tight stays, and other ligaments around the body, have been, and are still, the bane of young women. There is a certain neuralgic affection of the scalp that is immediately relieved by a tight bandage around the forehead—a practice evidently adopted in the earliest ages, for we are told by

Diodorus Siculus that it was believed Bacchus invented the diadem to cure his head-aches. Sir Gilbert Blane suggested the trial of mechanical compression of the head in hydrocephalus, and several cases have been recorded of its success.

625. Where our object is simple support or gentle compression, we should of course select a plaster which is the most adhesive, and the least irritating. Many compounds which have gained celebrity for their curative virtues, have probably been solely indebted to it for their adhesiveness; such is the *Emplast. Ferri* E, for it is difficult to believe that the iron can impart any tonic effect. In the cure of sore legs, the importance of adhesive strapping is generally acknowledged, and on such occasions nothing is superior to the *Emplast. Resinæ*, but with a less proportion of resin in its composition than that directed in the Pharmacopœia. Persons who are exposed to fatigue by the standing posture, as washerwomen, are particularly liable to sore legs, which may be prevented by this kind of support.

626. Anomalous pains affecting the joints, to which young females are liable, depending upon a peculiar morbid state of the nervous system, ("*Local Hysteria*" *of Brodie*,) are often cured by bandages and equable compression; so, again, the undue sensibility which follows inflammation is thus relieved, and the constant re-excitement of pain by any degree of inter-articular motion prevented.

627. Where our object is to prevent excoriation,* the plaster should never contain resin. The *Emplast. Saponis* will probably offer the best application.

628. To protect a wound from the action of the air, a point of no small importance in many cases, the animal membrane, sold under the name of "*gold-beater's skin*," is an admirable application. There are many forms of cutaneous disease,

* Dr. Christison states that a good external remedy, in cases of redness or excoriation from pressure, is a liniment composed of white of egg, briskly agitated with its own volume of rectified spirit, and frequently applied with a feather.—*Dispensatory.*

which after having defied all other treatment, have yielded to this simple remedy. "*Court Plaster*," made by brushing over black silk a mixture of isinglass and tincture of benzoin, is far too stimulating.*

Unguenta.

629. These are fats and oils, with which various active substances are incorporated, either by simply mixing the ingredients by trituration, or liquifying them by the aid of a gentle heat. The Pharmacopœia contains several *Formulæ* for the more important of these compounds, which the practitioner will frequently have occasion to combine, or modify, by extemporaneous prescription; he will also sometimes find it necessary to direct original combinations, in which case he will select prepared lard, (*Adeps*,) or some such simple ointment, as the *Unguentum Cetacei*, for the basis of his composition; and then proceed to enumerate the articles to be added, with or without the aid of heat, taking care to maintain a suitable consistence, by means of oil, should it be too dense, and by wax, should it be too soft; the latter expedient, however, will be rarely necessary, if powdered substances enter into its composition. As to the rest, chemistry must be his guide; it will guard him against such additions as are incapable of forming consistent and homogeneous mixtures; it will point out those which are capable of decomposing the basis.

630. In former times, unguents had a far more extensive application, as constitutional remedies,† than are at present

* Some skins are so irritable that the application of resinous plasters has produced erysipelatous eruptions.

† "Usus unguenti Medicis, Chirurgis, frequentissimus, emolliendi, discutiendi, maturandi, detergendi, calefaciendi, roborandi, sopiendi, demulcendi, acre corrigendi, etc. virtute pollens, non externas modo, sed penetrabilitate majore internas etiam partes afficit mutatque potentius." —*Gaubius.*

conceded to them; with few exceptions, they are regarded as local agents, and in this view of their utility, they are too often undervalued, especially as applications for the cure of cutaneous diseases. In herpes, psoriasis, and lepra, I have frequently applied with great success an ointment composed of a drachm of *Calomel* to an ounce of lard; and in many instances the addition of finely levigated chalk to an ointment has obviated such evil effects as have in general followed greasy applications. Some of the more potent alkaloids have been introduced into ointments; I have witnessed the beneficial effect of a preparation composed of a grain of *Aconitina* to an ounce of lard, in neuralgic affections, especially that form of it known by the name of *Tic Doloureux*. *Veratria* has been also extolled as an external application in the form of an ointment; but the evidence of its value is derived from authority of a very questionable nature.

Linimenta.

631. These are compositions which differ principally from ointments in having the consistence of oil, which imparts to them a form highly convenient for friction upon the skin.* With the exception of *Linimentum Æruginis*, and *Linimenta Camphoræ*, which might with great propriety be excluded from the officinal list, they are all *Soaps*, that is, compounds of oils and alkalies. They constitute a valuable class of remedies, and the observations which Dr. Percival has offered, with respect to their utility, well merit the attention of the practitioner. "Volatile and antispasmodic liniments are highly useful remedies, and it is to be lamented that external applications of this kind are not more frequently employed, for there is just reason to apprehend that powerful effects might be expected from them in various diseases." In

* *Illinire*, to besmear.

chronic affections of the viscera, such applications appear to be highly serviceable, not only from the friction they provoke, but from the influence of that species of sympathy which would seem to depend upon the proximity and continuity of parts, (45,) and which, as Sir Gilbert Blane expresses it, is particularly displayed "in the containing on the contained parts, as that of the integuments on the subjacent viscera." In their construction, to answer different indications, a wide field is open for extemporaneous prescriptions. See *Form.* 16.

Lotiones.

632. Remedies of a liquid, but not of an oily nature; to be applied more or less generally to different parts of the body. We have no officinal formulæ for their preparation, since their composition must necessarily be extemporaneous, and their application be varied according to the circumstances of each particular case, and the objects which we desire to fulfil. When the whole surface of the body is the subject of their application, they fall under the denomination of Balneum Humidum. If only the lower half, from the umbilicus downwards, Semicupium; (hip-bath;) if the feet only, Pediluvium; and should any circumscribed portion of the surface be alone submitted to the application, the term of *Lotion* becomes more strictly appropriate: *Embrocation** may be regarded as a synonym; I am not aware of any circumstance, either in its composition or mode of application, which can distinguish it from a lotion. A *Collyrium*† is a liquid application to the eyes, some of which are simply astringent, con-

* The term is derived from βρέκω, *irrigo.*

† The term was formerly applied to any medicine calculated to restrain defluxions, from κωλύω, inhibio, and ρους, fluxio.

sisting of the solutions of salts of lead or lime, or of vegetable infusions, of which that of green tea is an excellent application; while others combine with the astringent, the virtues of a stimulant. They are necessarily extemporaneous compounds.

Cataplasmata. *Poultices*, or *Pultices*.

633. External applications of a pulpy, and somewhat coherent or tenacious consistence. They may be regarded as extemporaneous, although the colleges have introduced several formulæ for their preparation.

634. The cataplasm was considered by the older pharmaceutists as generally consisting of three parts; a division that may be conveniently adopted for explaining the principal points to be considered in extemporaneously prescribing them, *viz.* 1. *Liquor;* 2. *Corpus;* (*cui inconquendum;*) 3. *Accessorium.* The *first* constitutes the fluid part, the *second* that which imparts to it a proper consistence, and the *third* any active ingredient by which it may be further medicated; thus in the "*Cataplasma Conii*" of the London College, water constitutes the *Liquor*, linseed the *Corpus*, and conium the *Accessorium;* in like manner, in the "*Cataplasma Sinapis*," the *Liquor* is vinegar, the *Corpus* linseed, and the *Accessorium* mustard.

635. Every substance, whether liquid or solid, may become an ingredient in this species of composition, and although judicious and experienced surgeons have of late years very considerably improved the form of their cataplasms, yet the principles of medicinal combination, which it has been the object of the present work to investigate and expound, will be found capable of useful application. Science does not withhold her aid even on the humble occasion of making a poultice. Although the direction, as well as preparation of

them, is more frequently left to the nurse than to the practitioner, yet in adapting them to their object some share of address may be necessary. The selection and proportion of the ingredients with respect to their power of conducting heat, their tenacity, and their chemical composition, are questions not without value.

636. Cataplasms are calculated to answer various indications, *viz.*

1. As Stimulants. The *Cataplasma Sinapis* is the favourite application for such a purpose. Dr. Christison, however, prefers the more simple plan of spreading mustard, as prepared for the table, upon a bread and water poultice, or without any such admixture upon a piece of linen. The propriety of adding vinegar to it has been doubted, and the question involves a scientific inquiry of some interest. It has been stated (475) that the volatile oil of mustard, upon which its pungency depends, is not an educt, but a product, formed on the addition of water to the former; and it would appear that acids check the chemical action by which it is produced; boiling water also has the same effect, hence its temperature ought not to exceed 100° *Fah.* The injurious effects produced on mustard by vinegar appears to have been known to Ætius, for he says, "*Si in Aceto maceretur Sinapi inefficacius redditur.*" Trousseau and Blanc have shown by experiments that a sinapism of mustard and flour, made with *water*, produced an effect in six minutes, that required fifty when *vinegar* was employed. It has, however, been said that this occurs only with the brown mustard of France, which contains a mixture of the husks, and that the activity of the English yellow farina is not thus impaired, which Dr. Pereira suggests may arise from the fact that common English flour of mustard contains pod pepper, the active principle of which (*Capsicin*) is soluble in vinegar. A poultice made with a solution of common salt has also been found useful, as a stimulant, for the reduction of indolent strumous swellings and enlargement of the glands.

2. As Antiseptics. Various combinations have been employed for this purpose. The *Cataplasma Fermenti* L. E., or one composed of ale or strong beer grounds, answers extremely well. A powerful antiseptic composition may also be made by stirring finely powdered charcoal into a common linseed meal poultice. (*Cataplasm. Carb. Lig.* D.) A cataplasm of boiled carrot, beat into a pulp, has been also found very effectual in sweetening foul and gangrenous ulcers.

3. As Sedatives. The most efficient of these have *Conium*, *Digitalis*, or *Hyoscyamus*, as *Accessoria*. They are eminently serviceable in cancerous and scrofulous sores of a highly irritable and painful nature. They are also beneficial in certain cutaneous affections of an irritable character, by diminishing the morbid sensibility of the part, and correcting acrid discharges. The *Cataplasma Conii*, with an infusion of digitalis, instead of water, has in my practice often proved very serviceable.

4. As Refrigerants. In the formation of a cataplasm of this kind, we must avoid the introduction of substances that are slow conductors of caloric; suppose, for example, our object is to apply the *Acetate of Lead* in this form, it will be judicious to mix the linseed-meal with *oatmeal* or *crumb of bread*;* for, if the former be used singly, it is liable, from its tenacity, to become hard and dry, and in that state to augment the temperature which it was designed to diminish.

5. As Emollients. The *modus operandi* of these agents has been already noticed (361); of which the common farinaceous poultice is perhaps the most eligible, made by soaking slices of bread in milk, and simmering them together over a gentle fire, until they are brought to such a consistence as may prevent the poultice spreading further than is desired, and yet not so stiff as may occasion any mechanical irritation; the whole is then to be beat smooth with a spoon, and applied as

* If the bread contains much alum, the acetate of lead will be rendered inert.

warm as the feelings of the patient will allow. Some practitioners have questioned the propriety of milk as the *Liquor*, not only because it is more likely to turn sour, but because it does not possess greater power than water as an emollient. The observations of the editor of the *Pharmacopœia Chirurgica* upon this subject are judicious. "The objection," he says, "will certainly hold good whenever stale milk is made use of, or if the same poultice be too long applied; but if the milk be fresh, and the poultice renewed night and morning, we do not know anything that occasionally gives such ease and comfort to the patient as this form of poulticing. If water be substituted for milk, the poultice is seldom of sufficient tenacity; it is true that this inconvenience may be obviated by the addition of a little linseed meal, but in some instances it appears to fret and irritate the skin* so much, that patients suffer considerable uneasiness from it; an objection to which the bread and milk alone are not exposed, especially if not applied too hot." One part of linseed meal with three of crumb of bread, will form a poultice of the requisite tenacity, without being liable to crumble.

637. A question will arise as to whether the poultice should be applied directly to the naked part, or through some thin intervening fabric. Where our object is to act upon the surface by a medicinal application, as in the instance of a sedative, the contact should be as complete as possible. All textures also, let it be remembered, however delicate they may be, are apt to fret the part by friction. They have, however, the advantage of preventing the poultice from shifting its position. The best material for this purpose is fine white gauze, which offers but little obstruction, and yet sufficiently confines the pulpy mass in its situation.

* The linseed has been frequently ground in mustard mills, and has thus occasioned considerable, and at the time inexplicable, irritation.

Vesicatoria. Blisters.

638. When treating of the therapeutic value of these medicinal agents, I promised to afford the practitioner some practical instructions with regard to their management, and to point out some popular fallacies in connexion with it. In the first place, it may be observed that a blister should be in sufficient contact with the surface, but that any undue pressure, by obstructing the capillaries, will retard its operation: strops of adhesive plaster will generally secure its position. With regard to the period it should be allowed to remain, practitioners have differed; my opinion is that it is generally kept on much longer than is necessary; and that in the case of children, more particularly, such a practice is not without danger. It is not necessary to retain it until vesication takes place; after its removal this effect will very generally occur; indeed, in many cases the surface will not rise until it has been dressed. To prevent the occurrence of strangury, as well as much unnecessary irritation from the adhesion of particles of the fly to the surface, the expedient proposed by M. Bretonneau should be adopted, that of interposing between the skin and the blister a thin piece of gauze, or paper, *well soaked in oil.* The oil, according to the experiments of M. Robiquet, being a solvent of the vesicatory principle, transfers its effects without any diminution to the skin, while the paper abstracts the grosser parts of the fly. The popular practice of copious potations to protect the kidneys from any anticipated irritation, is wholly erroneous; and actually counteracts any benefit which might be derived from the action of the blister as an evacuant. (357.) Erroneous views have also been entertained with regard to the effects of a blister bearing an exact proportion to its size. Large blisters, while they are far more efficient as evacuants, do not produce greater pain and constitutional irritation than those of smaller size. Where the local inflammation runs higher than we desire, no application

will prove more soothing than a common bread and water poultice; and in those cases in which the blistered surface refuses to heal kindly, as frequently happens with weak children, the common spermaceti ointment, if carefully mixed with finely levigated chalk, will often astonish the practitioner by the rapidity of its healing influence.

A COLLECTION OF FORMULÆ,

INTENDED TO ILLUSTRATE THE FOREGOING PRECEPTS,

AND TO

FURNISH THE INEXPERIENCED PRESCRIBER

WITH A

SERIES OF USEFUL AND INSTRUCTIVE LESSONS.

EXPLANATION OF THE KEY LETTERS.

THE *Modus Operandi* of the different elements of each formula is designated by a KEY LETTER, or *Symbol*, which is printed in a different type, (thus **B**,) and placed in the margin opposite to each. This letter refers to a corresponding one in the Synopsis, and thereby shows the division containing an exposition of the principle upon which the operation of the ingredient is supposed to depend.

Two or more KEY LETTERS denote that the element against which they are so placed has several modes of operation, whilst the order in which the letters succeed each other, serves to show the relative importance of them.

Where any one of the letters is *small*, *i. e.* not a capital, it denotes that the operation which it is intended to express is only *incidental* to, or subordinate in, the general scheme of the combination.

When any number of elements are included within a *vinculum* or bracket, it is intended to show that they operate but as one substance, or, that the virtues of each are not independent of the other; in this case the KEY LETTER within the bracket expresses upon what principle this unity depends, whilst that on the exterior shows the action of such a combination upon the base, or the part which it performs in the general scheme of the Formula.

Let us exemplify it by a reference to *Formula* 108, which

presents us with a purgative, in conjunction with a stimulant. The base is *Aloes*, which is succeeded by *Scammony*, and *Extract of Rhubarb;* these substances appear by the bracket, to act in unison, a concurrence which the interior letter **B** shows to depend upon their being SIMILAR REMEDIES; the letter on the exterior shows that they are calculated to produce the same ultimate effects as the base, but by different modes of operation. We next come to powdered *Capsicum*, and *Oil of Cloves;* these ingredients are also shown by a bracket to act in unity, and the letter **B** in the interior, denotes that it is in consequence of their possessing a similar mode of action, whilst the letter **G** on the exterior, announces that they act in the general scheme for the purpose of fulfilling a second indication; at the same time the smaller letter *e* informs us that the combination likewise acts as a *corrector* of the base.*

* In my lectures I formerly employed different colours for the purpose of expressing the object of each ingredient in a formula; in this manner very useful and instructive charts might be constructed: this hint may perhaps induce the industrious student, who is anxious to become a master in the art of prescribing, to attempt a synopsis upon this plan. During the progress of this work through its various editions, I have frequently received the thanks of young practitioners for the advantages they have obtained from adopting the plan here proposed; and I strongly recommend all those who are entering upon their professional career to exercise themselves in the construction of extemporaneous formulæ, and in placing opposite to each ingredient a key letter. By such a study they will not only acquire a facility in the art of prescribing, but they will learn to exclude every article which has not an obvious agency in the general scheme of a formula.

A SYNOPSIS

OF THE

Principles of Combination,

AS INVESTIGATED IN THE PRECEDING PAGES,

ARRANGED IN A TABULAR FORM,

SO AS TO AFFORD THE STUDENT AN EASY REFERENCE

TO

THE KEY LETTERS.

OBJECT I.

TO PROMOTE THE ACTION OF THE BASIS.

Key Letters.

A A.—*By combining the several different forms, or preparations, of the* SAME SUBSTANCE.

B B.—*By combining the Basis with Substances which are of an* ANALOGOUS NATURE, *i. e. which are individually capable of producing the same, or kindred effects, but with less energy than when in combination with each other.*

C C.—*By combining the Basis with Substances of a* DIFFERENT NATURE, *and which do not exert any Chemical influence upon it, but are found by experience, or inferred by analogy, to be capable of rendering the stomach, or system, more susceptible of its action.*

OBJECT II.

TO CORRECT THE OPERATION OF THE BASIS, BY OBVIATING ANY UNPLEASANT EFFECTS IT MIGHT BE LIKELY TO OCCASION, AND WHICH WOULD PERVERT ITS INTENDED ACTION, AND DEFEAT THE OBJECT OF ITS EXHIBITION.

D A.—*By* CHEMICALLY *neutralizing, or* MECHANICALLY *separating, the offending ingredient.*

Key Letters.

E A.—*By adding some substance calculated to guard the stomach, or system, against its deleterious effects.*

OBJECT III.

TO OBTAIN THE JOINT OPERATION OF TWO OR MORE MEDICINES.

F A.—*By uniting those Medicines which are calculated to produce the* SAME ULTIMATE RESULTS, *but by modes of operation totally different.*

G B.—*By combining medicines which have different powers, and which are required to obviate different symptoms, or to answer different indications.*

OBJECT IV.

TO OBTAIN A NEW AND ACTIVE REMEDY, NOT AFFORDED BY ANY SINGLE SUBSTANCE.

H A.—*By combining Medicines which excite different actions in the stomach and system, in consequence of which* NEW, *or* MODIFIED RESULTS *are produced.*

B.—*By combining substances which have the property of acting* CHEMICALLY *upon each other; the results of which are—*

Key Letters.

I a. *The formation of New Compounds.*

K b. *The Decomposition of the Original Ingredients, and the development of their more active elements.*

C.—*By combining Substances, between which no other change is induced than a diminution, or increase in the* SOLUBILITY *of the principles in which their Medicinal virtues reside.*

L a. *By the intervention of Substances that act* CHEMICALLY.

M b. *By the addition of Ingredients whose operation is entirely* MECHANICAL.

OBJECT V.

TO AFFORD AN ELIGIBLE FORM.

N a. *With reference to its* EFFICACY.

O b. ——— TASTE *or* APPEARANCE.

P c. ——— CONSISTENCE, *or* EQUABLE MIXTURE.

Q d. ——— PRESERVATION.

ILLUSTRATIVE FORMULÆ.

EXHILARANTS—EXCITANTS.

1. ℞. Ol. Carui ℥xv. . . . . B
Syrup. Zingib. fʒij. . . . . O B
Tere simul, et adde
Mist. Camphoræ fʒviss. . . . . P B
Tinct. Cardam. comp. . . . . B } B
et Spirit. Anisi, aa. fʒss. . . . .
Æther. Sulphuric. fʒij. *Basis.*

Fiat Mistura, de qua sumantur Cochlearia duo ampla, ad Inflationes levandas; et repetantur singulis horis donec sopiatur dolor.

In Flatulent Cholic.

An explanation of the order in which the different ingredients are here arranged has been already given (501).

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2. ℞. Ammoniæ Sesquicarb. ʒij.
Aquæ Menthæ Piperitæ fʒvij. . . . . N o. p. b.
Tere simul, et adde,
Tinct. Capsici fʒi. . . . . B } B
Tinct. Cinnamom. comp. fʒij. . . . .
Syrup. Aurantii fʒfs . . . . . O

Fiat Mistura, de qua sumantur Cochl. duo ampla in Languoribus.

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3. ℞. Infus. Armoraciæ comp. fʒix.
Tinct. Ammoniæ comp. ℥viij. . . . . B
Syrup. Zingib. fʒj. . . . . O B

Fiat Haustus.

4. ℞. Infus. Caryophyll. ʒix.
Tinct. Cardamom. co. ʒj. . . . . .
Spir. Myristicæ ʒʃs. . . . . B } B
Spir. Ammoniæ Aromat. ʒʃs. . . . .
Syrup Zingib. ʒj. . . . . O B
Fiat Haustus.

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5. ℞. Olei Cajuputi ♏iv.
Sacch. alb. gr. v. . . . . P O
Tere simul, et adde
Infus. Calumbæ ʒix. . . . . A } G
Tinct. Calumb. ʒi. . . . . .
Fiat Haustus, bis quotidie sumendus.

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6. ℞. Ammoniæ Sesquicarb. gr. v.
Infus. Serpentariæ ʒix. . . . . A } B P
Tinct. Serpentariæ ʒj. . . . .
Syrup. Zingib. ʒj. . . . . O b.
Fiat Haustus, in virium deliquio sumendus.

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7. ℞. Aquæ Menth. Piperit. ʒx.
Tinct. Sennæ comp. . . . . B } G
et Tinct. Rhei co. aa. ʒj. . . . . .
Fiat Haustus urgenti Flatu sumendus.

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8. ℞. Ammoniæ Sesquicarb. gr. v.
Assafœtidæ gr. iij. . . . . B
Gradatim addendo, et simul terendo,
Spir. Armoraciæ comp. ʒij. . . . . B b.
Decoct. Aloes. comp. ʒx. . . . . G p.
Fiat Haustus, in distentionum accessionibus hystericis sumendus.

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9. ℞. Mist. Guaiaci ʒix.
Tinct. Guaiac. co. ʒʃs. . . . . A
Fiat Haustus.

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10. ℞. Tinct. Cantharidis ♏xv.
Decoct. Hordei ʒix. . . . . E
Syrup. Aurantii ʒj. . . . . O p.
Fiat Haustus.

11. ℞. Confect Piperis Nigri ʒj.
Assafœtidæ gr. v. . . . . G
Syrup. Zingib. q. s. . . . . P b.
Ut fiat Electuarium, idoneæ crassitudinis, bis quotidie sumendum.
Adversus Hæmorrhoides.

Alterum ad idem valens.

12. ℞. Assafœtidæ ʒij.
Pulv. Capsici ℈ij. . . . . G
Syrup. Zingib. q. s. . . . . P b.
Ut fiat Massa in Pilulas xxx. *dividenda, e quibus sumantur duæ, sextis horis. Cave ut Vasculo vitreo includantur.*

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13. ℞. Lactis Vaccini Oj.
Sinapis contusæ ℥j. . . . . K
Coquantur simul, donec pars caseosa in coagulum abiret, deinde coletur liquor.
℞. Colaturæ cyathum.
Syrup. Zingib. fʒj. . . . . O
Fiat Haustus, bis terve de die sumendus.

Stimulantia Extrinsecus admovenda.

14. ℞. Decoct Papaveris ferventis Oij.
Sinapis, ℥iij. . . . . G
Misce. *Imponatur ventri pannus laneus hoc liquore calido bene imbutus, et mox leviter expressus; et renovetur iterum iterumque, donec dolor remisit.*

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15. ℞. Liniment. Ammoniæ fʒj.
Fiat Embrocatio cum panno laneo faucibus externis applicanda.

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16. ℞. Liniment. Camphoræ comp. fʒix.
Tinct. Cantharidis fʒj. . . . . B
Tinct. Opii fʒfs. . . . . G
Fiat Linimentum, quo oblinantur partes distentionibus laborantes.

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17. ℞. Saponis ʒj.
Emplast. Plumbi ʒij. I
His simul liquefactis, et ab igne remotis, adjice
Ammoniæ Hydrochlorat.
In Pulverem subtilem contritæ ʒfs. . . . K
Sit Emplastrum, super aluta debitæ magnitudinis et figuræ extensum, Scuto pectori.

NARCOTICS.

18. ℞. Camphoræ gr. ij.
Spir. Rectificat. ♏j. . . . . **P**
Tere simul, et adde,
Extract Hyoscyam. gr. iij. . . . . **B**
Fiat Pilula hora decubitus sumenda, et somno averso, media nocte repetenda.

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19. ℞. Opii gr. iij.
Extract. Hyoscyam. . . . . } **B B**
et Extract. Conii aa. gr. xv. . . . . }
Simul contunde, et fiat Massa in Pilulas sex dividenda; e quibus, amylo obvolvendis, capiatur una, singulis noctibus, ad somnum conciliandum.

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20. ℞. Extract. Lactucæ.
et Extract. Lupuli aa. gr. v. . . . . **B**
Misce. *Fiant Pilulæ duæ h. s. sumendæ.*

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21. ℞. Extract. Stramonii gr. ſs.
Extract. Hyoscyam. gr. iv. . . . . **B**
Fiat Pilula h. s. sumenda.

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22. ℞. Pill. Styracis comp. gr. iii.—v.
Extract. Aloes gr. j. . . . . **G E**
Fiat Pilula.

Altera ad idem valens.

℞. Pil. Saponis comp. gr. iii.—v.
Extract. Colocynth. co. gr. ij. . . . **G E**
Fiat Pilula, quam singulis noctibus sumat cubitum iturus.

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23. ℞. Opii Contriti gr. v.
Aquæ Destillatæ ƒ℥iij.
Infunde prope ignem per horam, et cola.

℞. Colaturæ ƒ℥x.
Syrup. Limon. ƒ℥j. . . . . **O L**
Fiat Haustus, p. r. n. sumendus.

24. ℞. Colaturæ supra præscriptæ fʒix.
Acid. Nitric. Dilut. ♏v. . . . . E
Tinct. Aloës, co. fʒj. . . . . G E
Syrup. fʒſs. . . . . O
Fiat Haustus.

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25. ℞. Tinct. Opii ♏xx.
Syrup. Papav. fʒj. . . . . B O
Spir. Cinnamomi fʒj. . . . . O
Decoct. Aloës co. fʒx. . . . . P G E
Fiat Haustus.

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26. ℞. Morphiæ Acetatis, grani partem tertiam.
Aceti Destillati ♏ij. L
Aquæ Flor. Aurantii fʒij. . . . . O
Aquæ Destillatæ fʒj. . . . . P
Syrup. Aurantii fʒſs. . . . . O
Fiat Haustus Pacificus.

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27. ℞. Aconiti Foliorum exsiccat. ʒj.
Spir. Tenuioris fʒj. . . . . K
Macera per dies septem in vase probe clauso, et cola.

℞. Colaturæ ♏v.
Mist. Camphoræ fʒj. . . . . F G
Vini Antimonii Potassio-Tart. ♏xv. . . .
Fiat Haustus.—(In Arthritide et Rheumatismo.)
Sin Forma Pilulæ magis arrideat, utatur sequenti.

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28. ℞. Extract. Aconiti gr. j.
Pil. Hydrarg. Chlorid. co. gr. j. . . . . G
Fiat Pil. mane et sero sumenda.

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29. ℞. Extract. Conii ʒj.
Aquæ ad gradum cxx. calefactæ. Oſs. . . . P
Tinct. Conii fʒj. . . . . A
Fiat Solutio, cujus vapor calidus haurietur in Pulmones, Infundibuli ope, per horæ circiter partem decimam, ter quotidie.

ANTISPASMODICS.

30. ℞. Tinct. Castorei f℥j.
Mist. Acaciæ f℥ij. . . . . P
Tere simul, et adde
Infus. Valerian f℥iſs. . . . .
Tinct. Opii ℥v. . . . . B } B
Ætheris Sulphurici ℥xv. . . . .
Fiat Haustus omni hora, donec sopiatur dolor, sumendus.

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31. ℞. Moschi ℈j.
Acaciæ gummi contriti ʒſs. . . . . P
Tere probe simul, et adde
Aquæ Ros. f℥iſs. . . . . O
Æther. Sulph. f℥ſs. . . . . B
Fiat Haustus.

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32. ℞. Mist. Camphoræ f℥ix. . . . . P *b.*
Spir. Ammoniæ Fœtid. f℥ſs. *Basis.*
Fiat Haustus ter quotidie sumendus.

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33. ℞. Assafœtid. ʒj.
Aquæ Menth. Pip. f℥iſs. . . . . P *b.*
Tere cum Aqua Menthæ Pip.: paulatim instillatâ, donec optime misceantur, et dein adde
Tinct. Valerian. Ammon. f℥ij. . . . B } B
Ætheris Sulphurici f℥j. . . . .
Fiat Mistura, de qua sumatur Coch. unum amplius, secundis horis.
Signetur, The Antihysteric Mixture.

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34. ℞. Ol. Cajuput. ℥v.
Magnesiæ gr. x. . . . . P
Tinct. Castorei f℥ſs. . . . . B } B
Tinct. Opii ℥v. . . . . P B
Mist. Camphoræ f℥ix. . . . .
Fiat Haustus.

35. ℞. Valerian. Rad. in Pulv. contrit. ℈j.
Mist. Acaciæ fʒj. . . . . P
Infus. Valerian fʒix. . . . . A
Tinct. Valerian fʒj. . . . . A
Tinct. Castorei fʒj. . . . . B
Fiat Haustus ter quotidie sumendus.

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36. ℞. Valerian Rad. in pulv. contrit. ʒiij.
Cinchonæ Lancifoliæ Pulv. ʒj. C
Syrup. Aurantii q. s. . . . . P O
Ut fiat Electuarium idoneæ crassitudinis, cujus devoret drachmam mane ac vesperi. *Mead.*

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37. ℞. Pil. Galbani comp. ℈ij.
Extract Aloës gr. vj. . . . . G
Opii gr. iij. . . . . F
Fiat Massa in Pil. xij. *dividenda, e quibus sumantur duæ bis quotidie.*

TONICS.

38. ℞. Infus. Cascarillæ fʒiſs.
Tinct. Cascarillæ fʒij. . . . . A
Spir. Myristicæ fʒſs. . . . . O
Syrup. Zingib. fʒj. . . . . O
Fiat Haustus bis terve quotidie sumendus.

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39. ℞. Infus. Quassiæ fʒvj.
Tinct. Calumbæ fʒij. . . . . B e.
Aquæ Cinnamom. fʒv. . . . . P e.
Syrup. Aurantii fʒj. . . . . O
Fiat Haustus, ut prior sumendus.

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40. ℞. Infus. Calumbæ fʒix.
Tinct. Calumbæ fʒj. . . . . A
Acid. Sulph. Dilut. ♏x. . . . . F
Syrup. Aurantii fʒſs. . . . . O
Fiat Haustus.

41. ℞. Acid. Hydrochloric. Dilut. ♏xx.
Infus. Aurantii comp. fʒix. . . . . F
Syrup. Zingib. fʒj. . . . . O
Fiat Haustus, horis ij. *ante prandendum quotidie sumendus.*

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42. ℞. Infus. Gentianæ comp. fʒix.
Tinct. Gentianæ comp. fʒij. . . . . A
Syrup. Aurantii fʒj. . . . . O
Fiat Haustus bis quotidie sumendus.

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43. ℞. Infus. Gentianæ comp. fʒix.
Tinct. Sennæ comp. fʒij. . . . . B G
Potassæ Tart. ʒj. . . . . B G
Syrup. Zingib. fʒj. . . . . O
Fiat Haustus, ut priores quæ stomacho subveniant, adhibendus.

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44. ℞. Cinchonæ Lancifoliæ contus. ʒfs.
Aquæ Destillatæ fʒxij.
Coque per sextam horæ partem, adjectis sub finem concoctionis.
Serpentariæ Radicis contus. ʒij. . . . . G
Stent per horam in vase leviter clauso, et colaturæ egelidæ adjice
Spiritum Cinnamomi fʒj. . . . . E O
Acid. Sulphuric. Dilut. fʒij. . . . . G
Fiat Mistura, de qua sumantur Cochl. ij. *ampla sexta quaque hora.*
Pringle.

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45. ℞. Pulveris Cinchonæ, et
Potassæ Bitart. aa ʒj. . . . . G
Carophyll. pulv. ʒfs. . . . . E O
Misce, et detur drachma cum semisse tertiis horis. *Petrie.*

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46. ℞. Pulveris Cinchonæ ʒfs. ʒj.
Pulveris Cinnamomi comp. gr. x. . . . E O
Misce, et sit pulvis, febre inclinatâ, quater quotidie, per decem dies capiendus; deinde, bis per decem alios dies. Si pulverem respuat stomachus, haustus sequens vicem ejus implere liceat.

℞. Quinæ Disulphatis gr. ij.
Acid. Sulphuric. Dilut. ♏ij. L
Aquæ Cinnamomi fʒix. . . . . P O
Syrup Aurantii fʒj. . . . . O

47. ℞. Infus. Gentian. comp. fʒivſs.
Infus. Rhei fʒj . . . . . F
Tinct. Cardamom. comp. fʒiij. . . . . G e. o.
Syrup. zingib. fʒj . . . . . O
Fiat Mistura, de qua sumantur Cochl. ij *ampla, hora post jentaculum, totidemque horis duabus ante prandendum.*

Contra stomachi mala.

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48. ℞. Ferri Potassio-Tart. gr. xij.
Infus. Quassiæ fʒſs. . . . . F C
Aquæ fʒj . . . . . P
Syrup. Zingib. fʒj. . . . . O
Fiat Haustus bis quotidie sumendus.

Alius et gratior.

℞. Potassæ Bicarbonatis, ℈j.
Ferri Ammonio-citrat. gr. xij. . . . . G
Aquæ Destillatæ, fʒxij.
Fiat Haustus, miscendo, tempore usus, pulverem infra præscriptum, moxque in ipso effervescentiæ impetu hauriatur.

℞. Acid. Citric. in
Pulverem triti gr. xv. . . . . K
Sacch. alb. gr. v. . . . . O
Misce, et fiat pulvis.

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49. ℞. Mist. Ferri comp. fʒx.
Ammoniæ Sesquicarb. gr. v. . . . . G
Tere simul, et fiat Haustus bis quotidie sumendus.

Aliter,

℞. Pil. Ferri comp. ℈ij.
Extract Aloes, gr. vj. . . . . G
Fiat Massa in Pil. xij. *dividenda, e quibus sum. duæ bis quotidie.*

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50. ℞. Cupri Ammonio-sulphat. gr. iij.
Micæ planis, q. s. . . . . P
Ut fiat Pilula bis quotidie sumenda.

51. ℞. Liquor. Potassæ Arsenitis ♏iv.
Mist. Camphoræ ʒix. . . . P
Tinct. Opii ♏ij. . . . . E
Syrup. Zingib. fʒſs. . . . . O
Fiat Haustus bis quotidie sumendus.

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52. ℞. Strychniæ gr. j.
Aceti Destillati, fʒj. L
Fiat Solutio, cujus sumantur ♏vj *ex aqua fontana bis quotidie.*

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53. ℞. Bismuthi Trisnitrat. gr. viij.
Mist. Acaciæ fʒj . . . . . P
Ammoniæ Sesquicarb. gr. v. . . . . G
Tere simul, et adde,
Mist. Amygdal. fʒij. . . . . O P
Fiat Haustus bis quotidie sumendus.

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54. ℞. Mist. Ferri comp. ʒix.
Ol. Cajuput. ♏v. . . . . G
Fiat Haustus bis quotidie sumendus.

ASTRINGENTS.

55. ℞. Decoct. Quercus fʒiſs.
Pulv. Gallarum, gr. x. . . . . B
Tinct. Catechu fʒſs. . . . . B
Tinct. Card. comp. fʒj . . . . . E
Syrup. Aurantii fʒj. . . . . O
Fiat Haustus bis quotidie sumendus.

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56. ℞. Infus. Catechu comp. fʒix.
Confect Aromat. ℈j. . . . . G
Tinct. Catechu fʒj. . . . . A Q
Fiat Haustus, ut prior dandus.

57. ℞. Infus. Cuspariæ fʒj.
Tinct. Catechu fʒj. . . . . B
Vini Ipecac. ℥xx. . . . . H } F
Tinct Opii ℥v. . . . . }
Fiat Haustus.

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58. ℞. Aluminis Contriti ʒij. . . . . K } I
Lactis Vaccini ferventis Oj. . . . . }
Ebulliant simul, ut fiat coagulum; quo separato, sum. cyathus seri Aluminosi, subinde, addendo singulis,
Spirit. Myristicæ fʒſs. . . . . O e.

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59. ℞. Aluminis Contriti ʒj . . . . . K } I
Albuminis ovi unius . . . . . }
Agita, et separetur coagulum, ut fiat cataplasma, linteo excipiend. et oculo inflammato admovend.

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60. ℞. Aluminis Exsiccat. Contriti gr. xij.
Myristicæ Nuclei subact. gr. viij. . . . . E
Extract Hæmatoxyli q. s. . . . . F P
Ut fiat massa in Pilulas vj. *dividend. e quibus sumatur una bis indies.*

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61. ℞. Aluminis Contriti ℈j
Infus. Ros. comp. fʒv. . . . . P b.
Oxymel. fʒſs. . . . . F
Tinct. Myrrhæ fʒij. . . . . G
Tinct. Capsici fʒj. . . . . G
Sit pro Gargarismate sæpius utend.

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62. ℞. Plumbi Acetatis gr. iij.
Opii gr. j. . . . . B } G E
Extract. Conii gr. v. . . . . }
Fiat massa, in Pilulas duas dividenda; quas sumat bis quotidie, superbibendo Haustulum aliquem acetosum, donec sanguinis profluvium cessaverit.

63. ℞. Opii duri contriti ʒſs.
Aquæ ferventis fʒiv.
Infunde per horam, et liquori colato adjice
Aquæ fʒiv, in qua
Liquata est Plumbi Acetatis ʒſs. . . . . G
Agita, et denique cola, ut separetur Plumbi Meconas, et fiat Lotio.

---

64. ℞. Infus. Ros. comp. fʒiſs.
Acid. Nitric. Dilut. (vice
Acid. Sulph. Dilut.) ɱxx . . . . . G
Syrup. Rhæados fʒj. . . . . O
Fiat Haustus.

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65. ℞. Zinci Sulphatis . . . . . } I
Plumbi Acetatis . . . . . }
Camphoræ in pulverem
(Ope Spir. Rectificat.) contritæ . . . G
Opii duri contriti, aa gr. vj. . . . . G
Syrupi fʒij. . . . . P
Tere simul, et adde
Aquæ Rosæ fʒvſs. . . . . P
Fiat Liquor, cujus quantum satis sit quater de die, ope siphunculi eburnei, in urethram injiciatur.

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66. ℞. Mist. Cretæ comp. fʒij.
Confect Aromat. gr. x. . . . . E
Tinct. Opii ɱij. . . . . G
Vel aliter,
℞. Extract. Hamatoxyli ʒſs
Aquæ fʒij. . . . . P
Tinct. Opii ɱij. . . . . G
Horum utriusvis drachmæ duæ ter quotidie sumantur, ad alvum comprimendam in Pueris.

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67. ℞. Mist. Cretæ comp. fʒiſs
Tinct Opii ɱxv. . . . . F
Tinct. Catechu fʒj. . . . . F
Fiat Haustus, alvo perturbata, post singulas sedes liquidas, sumendus.

68. ℞. Mist. Cretæ comp. ʒvij.
Mist. Ferri comp. ʒiij. . . . . F
Ammoniæ Sesquicarb. gr. v. . . . . G
Tere simul, et fiat Haustus, contra alvi ductionem nimis crebram, p. r. n. sumendus.

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69. ℞. Decoct. Quercus, ʒvj.
Infus. Lini fʒs. . . . . E
Mistura sit, pro injectione per vaginam, mane ac vespere infundenda, et ægra decumbente, aliquamdiu retinend.
Adversus Profluvium acre mulierum.

Alia, ad eundem scopum.

70. ℞. Liquor. Aluminis comp. fʒviij.
Tinct. Opii, fʒij. . . . . G

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71. ℞. Tinct. Ferri Sesquichloridi, ♏x.
Mist. Camphoræ fʒj. . . . F P
Fiat Haustus, tertia quaque hora sumendus.
In Dysuria.

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72. ℞. Decoct. Tormentillæ fʒix.
Vini Ipecac. ♏xx. . . . } H F
Tinct. Opii ♏x. . . . .
Fiat Haustus, semel aut bis quotidie sumendus.
Ad alvum coercendam in Phthisi.

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73. ℞. Decoct. Uvæ Ursi fʒx.
Extracti ejusdem gr. x. . . . . A
Vini Ipecac. ♏xv. . . . . F
Fiat Haustus bis quotidie sumendus.

74. ℞. Cupri Sulphatis gr. j.
Opii duri contriti gr. ij. . . . . G e.
Extract. Hyoscyam. q. s. . . . . P e.
Ut fiat massa in Pilulas iv. *dividenda, e quibus sumatur una ter quotidie.*
In ulcusculis intestinorum canalem obsidentibus.

SEDATIVES.

75. ℞. Acid. Hydrocyanic. Dilut. ♏ij.
Aquæ f℥ſs. . . . . P
Sacch. alb. gr. v. . . . . O
Fiat Haustus quarta quaque hora sumend.

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76. ℞. Acid. Hydrocyanic. Dilut. f℥j.
Aquæ Rosæ f℥j. . . . . P
Sil pro lotione, adversus Impetigines adhibenda. Signetur—Poison.

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77. ℞. Plumbi Acetatis gr. viii.
Aquæ Destillatæ f℥viiſs. . . . . P
Spir. Rectificat. f℥ſs. . . . . Q
Acid. Hydrocyanic. Dilut. f℥ij. . . . F
Fiat Lotio, ut prior utenda.

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78. ℞. Tinct. Digitalis ♏x.
Mist. Camphoræ f℥ix. . . . . P b.
Acid. Hydrocyanic. Dilut. ♏ij. . . . F
Fiat Haustus, bis terve de die sumendus.

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79. ℞. Antimonii Potassio-Tart. grani partem quartam.
Aquæ Destillatæ f℥j. . . . . P
Syrup. f℥j. . . . . O
Fiat Haustus, alternis horis sumendus; instillando, si diarrhœa accesserit, Tinct. Opii ♏iij.

EMETICS.

80. ℞. Antimonii Potassio-Tart. gr. j.
Aquæ puræ fʒiſs. . . . . P
Vinii Ipecac. fʒij. . . . . B
Fiat Haustus.

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81. ℞. Antimonii Potassio-Tart. gr. ij.
Aquæ fʒiv. . . . . P
Solve. Hujus liquoris danda sunt cochl. ij. *mediocria, singulis horæ quadrantibus, donec vomitus excitandus sit.* *Pro Infantibus.*

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82. ℞. Antimonii Potassio-Tart. gr. j.
Pulv. Ipecac. ℈j. . . . . E
Fiat Pulvis, ad vomitum excitandum.

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83. ℞. Pulv. Ipecac. ℈j.
Vini Ipecac. fʒij. . . . . A
Aquæ fʒj. . . . . P
Fiat Haustus vesperi sumendus.

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84. ℞. Zinci Sulphatis ℈j.
Aquæ fʒiij. . . . . P
Fiat Haustus. Post quamlibet vomitionem superbibantur cyathi aliquot Aquæ tepidæ, in qua Anthemidis Flores infusi sunt.

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85. ℞. Cupri Sulphatis gr. viij.
Aquæ fʒiij. . . . . P
Fiat Haustus, statim sumendus; superbibendo, ut supra, aquam tepidam.

CATHARTICS.

86. ℞. Magnesiæ Sulphatis ʒvj.
Aquæ Menthæ Viridis fʒvſs. . . . **L**
Vini Antimonii Potassio-Tart. fʒij. . . . **C**
Fiat Mistura, de qua sumantur cochl. ij. *ampla ter quotidie, vel donec alvus bis dejecerit, singulis diebus.*

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87. ℞. Magnesiæ Sulphatis ʒij.
Infus. Rosæ comp. fʒix. . . . . **P**
Acid. Sulphuric. Dilut. ♏x. . . . **L**
Syrup. Rhæados fʒſs. . . . . **O**
Fiat Haustus, bis quotidie sumend.

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88. ℞. Magnesiæ Sulphatis ʒj.
Potassæ Bicarb. ʒij. . . . . **G**
Aquæ Menthæ Piperit. fʒvſs. . . . **P** e.
Syrup. fʒij. . . . . **O**
Fiat Mist.

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89. ℞. Sodæ Sesquicarb. (in crystallis) ʒiiſs. . } **K** } **I**
Potassæ Bitart. ʒiij. . . . }
Aquæ fʒviij. . . . .
Stent in lagena probè clausâ per triduum; et deinde sit in promptu, dosibus partitis, pro potu cathartico. *Young's Med. Lit.*

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90. ℞. Sodæ Sesquicarb. ʒij. . . . } **K** } **I K**
Ferri Sulphat. gr. iij. . . . }
Magnesiæ Carbonatis ʒj. . . . }
Aquæ Oſs. . . . . }
Acid. Sulph. Dilut. fʒx. . . . }
Infundatur lagenæ aqua, in qua liquantur sales, acido deinde adjecto, illico obturetur vas, et in loco frigido, vel potius sub aqua egelida, servetur.

See Sect. 468.

91. ℞. Magnesiæ Sulphat. ʒſs.
Ferri Sulphat. gr. viij. . . . . G
Aquæ fʒviiſs. . . . . P
Acid. Sulph. Dilut. ɱx. L
Syrup. fʒij. . . . . O
Fiat Mist. cujus tepifactæ sum. cochl. ij. *ampla bis quotidie.*

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92. ℞. Magnesiæ ℈ij.
Pulv. Rhei gr. xv. . . . . B
Pulv. Zingib. gr. v. . . . . E
Fiat Pulvis, quem capiat quotiescunque diem sine alvi dejectione transegerit.

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93. ℞. Sennæ ʒiij.
Theæ Bohea ʒj. . . . . E
Zingib. Concisæ ℈j. . . . . E
Aquæ Destillatæ ferventis fʒiv. . . . L
Macera per horam, in vase leviter clauso, et cola.
℞. Colaturæ fʒx.
Tinct. Sennæ . . . . . A
et Tinct. Jalapæ, aa. fʒj. . . . . B
Syrup. Sennæ fʒj. . . . O A
Fiat Haustus summo mane sumendus.

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94. ℞. Infus. Sennæ comp. fʒij.
Sodæ Potassio-Tart. ʒſs. . . . F e.
Infus. Calumbæ fʒiſs. . . . C E
Fiat Solutio, duabus vicibus sumenda.

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95. ℞. Decoct. Aloës comp. fʒvſs.
Infus. Sennæ comp. f. fʒij. . . . A } B
Tinct. Sennæ . . . . }
Tinct. Jalapæ. aa. fʒij. . . . . B
Fiat Mistura, de qua sumantur coch. ij. *ampla bis quotidie, mane, et sero.*

96. ℞. Ol. Cajuput. f℥ss. . . . . G
Magnesiæ ℈j. . . . . F
Mist. Acaciæ . . . . . P
Tere simul, et adde
Decoct. Aloës comp. f℥v. *Basis.*
Infus. Sennæ comp. f℥ij. . . . . B
Tinct. Rhei comp. f℥ss. . . . . B
Tinct. Cinnamomi comp. f℥ij. . . . E
Fiat Mistura, adversus inflationem, cum alvo astrictâ, sumenda. Dosis major minorve pro variis conditionibus.

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97. ℞. Balsami Peruviani ℥ij.
Ovi Unius Vitellum . . . . P
Tere simul, et adde
Aquæ Cinnamomi f℥vij. . . . P O
Tinct. Aloes, co. f℥ss. . . . . F
Syrup. Croci f℥ij. . . . . O
Fiat Mistura, de qua quotidie sumantur cochl. ij. *ampla ad alvum tardam leniter movendum.*

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98. ℞. Aloes ℥j.
Rhei Radicis . . . . . B
et Calumbæ Rad. contrit. aa. ℥ss. . . . G
Liquor Calcis f℥viij. L
Infunde per horas duodecem, in vase clauso; cola, et adde
Spir. Armoraciæ comp. f℥ss. . . E G
Fiat Mistura de qua sumantur Cochl. ij. *ampla bis de die.*

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99. ℞. Infus. Sennæ comp. f℥ix.
Tinct. Aloes f℥ij. . . . B
Tinct. Gentian. comp. f℥j. . . . G H
Sodæ Sesquicarb. gr. v. . . . G l.
Fiat Haustus.

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100. ℞. Mist. Gentian. comp. f℥ix.
Tinct. Rhei comp. f℥ij . . . B
Tinct. Cubebæ f℥j. . . . G E
Fiat Haustus.

101. ℞. Scammon. contrit. gr. ij.
Potassæ Sulphatis gr. x. . . . . B M
Mist. Acaciæ ʒij. . . . . P
Tere simul, et adde
Mist. Amygdal. fʒj. . . . . P O
Spir. Myristicæ fʒſs. . . . . E
Fiat Haustus.

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102. ℞. Ol. Ricini fʒij.
Vitelli Ovi. q. s. . . . . M O
Tere optime simul, hisque inter terendum paulatim adjice
Aquæ Cinnamomi fʒix. . . . B } E P
Spir. Myristicæ fʒſs. . . . }
Tinct. Sennæ . . . . B } B
et Tinct. Jalapæ, aa. fʒj. . . . }
Fiat Haustus.

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103. ℞. Ol. Ricini fʒiij.
Ol. Terebinth. fʒj. . . . . B
Vitelli Ovi. q. s. . . . . O
Simul terantur, hisque adde
Aquæ Menthæ Piperit. fʒj. . . . E
Tinct. Jalapæ fʒij. . . . . B
Fiat Haustus quamprimum sumendus, et nisi inter horas duas viam sibi prius per alvum faciat, repetendus.

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104. ℞. Sulphuris ʒj.
Magnesiæ gr. xv.
Tere simul, mediante Mist. Acaciæ, et adde
Mist. Amygdal fʒx. . . . P O
Syrup. Zingib. fʒſs. . . . . O e.
Fiat Haustus.

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105. ℞. Confect. Scammonii ℈ij.
Confect. Piperis Nigri ℈j. . . G E
Misce, et fiat Electuarium.

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106. ℞. Confect. Sennæ ʒiſs.
Pulv. Jalapæ ʒſs. . . . . B
Sulphuris ʒſs. . . . . B
Syrup. Sennæ, q. s. . . . . P b.
Ut fiat Electuarium, de quo capiat instar nucis moschatæ, ter quotidie, vel donec alvus commode moveatur.
Adversus Hæmorrhoid.

107. ℞. Extract Colocynth. comp. ℈ij.
Opii gr. iij. . . . . G
Olei Pimentæ ♏v. . . . . E

Fiat Massa in Pilulas xij. *dividenda, e quibus sumantur duæ, alternis horis, vel donec bis dejecerit alvus.*

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108. ℞. Aloës contritæ ℥j.
Scammonii gr. xij. . . . } B
Extract. Rhei ℥ij. . . . } B
Capsici contus. gr. vj. . . . } B
Olei Carui ♏v. . . . } G e.
Syrup. q. s.

Fiat Massa, in Pil. xvj. *dividend. e quibus sumantur duæ, hora decubitus.*

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109. ℞. Hydrarg. Chlorid. gr. ij.
Saponis gr. j. . . . . P
Aloës gr. vj. . . . . F

Misce, et fiant Pilula duæ, p. r. n. sumend.

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110. ℞. Extract. Colchici Acet. gr. j.
Pil. Hydrarg. gr. iv. . . . . F

Fiat Pil. o. n. sumenda.

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111. ℞. Extract. Colocynth. comp. gr. v.
Extract. Hyoscyam. gr. iij. . . . E

Fiat Pilula, h. s. sumenda.

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112. ℞. Extract. Colocynth. comp. ℥ij.
Scammonii gr. xij. . . . . B
Saponis gr. vj. . . . . P

Fiat Massa in Pilulas xij. *dividenda. e quibus sumatur una vel altera, p. r. n. ad alvum officii immemorem excitandam.*

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113. ℞. Pil. Rhei comp.
et Pil. Sagapeni comp. aa gr. v. . . . G

Misce, et fiant Pilulæ duæ h. s. sumendæ.

114. ℞. Extract. Colocynth. comp. gr. vj.
Assafœtidæ gr. iij. . . . . **G**
Fiant Pilulæ ij. *p. r. n. sumendæ.*

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115. ℞. Tiglii Olei ♏ij.
Olei Caryophyll. ♏j. . . . . **E**
Micæ panis q. s. . . . . **P**
Ut sit Pilula, statim sumend. et horis duabus interpositis, nisi viam sibi prius faciat, repetenda.

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116. ℞. Elaterii gr. j.
Spir. Tenuioris f℥ſs. . . . . **L**
Solve, et sumat Hypropicus. *Heberden.*

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117. ℞. Elaterii gr. j.—ij.
Saponis gr. viij. . . . . **P**
Misce, et Fiat Suppositorium.

EMMENAGOGUES.

118. ℞. Pil. Aloës cum Myrrhâ gr. iij.
Ferri Sulphatis gr. j. . . . . **G**
Fiat Pilula ter quotidie sumenda.

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119. ℞. Myrrhæ contritæ ℈j.
Ferri Ammonio-chlorid. gr. v. . . . **F**
His simul tritis adde
Syrup. Zingib. q. s. . . . **P O**
Ut fiat Electuarium, bis quotidie sumendum.

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120. ℞. Pil. Aloës c. Myrrhâ,
et Pil Galb. comp. aa ʒj. . . . . **F**
Misce, et divide massam in Pil. xxiv.; *e quibus sumantur binæ bis quotidie.*

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121. ℞. Ergotæ gr. vi.
Confect. Ros. q. s. . . . . **P**
Ut fiat Pil. ij. *bis indies sumend.*

DIURETICS.

122. ℞. Infus. Digitalis f℥j.
Tinct. Digitalis ♏xv. . . . . A
Potassæ Acetat. gr. x. . . . . B
Syrup. Croci f℥ss. . . . . O

Fiat Haustus, tertia quaque hora sumendus.

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123. ℞. Infus. Digitalis
et Liquor. Ammoniæ Acet. aa f℥v. . . . B
Potassæ Nitrat gr. v. . . . . B
Syrup. Aurantii f℥ss. . . . . O

Fiat Haustus, ut supra dandus.

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124. ℞. Infus. Scoparii f℥iiiss.
Liquor. Ammon. Acet. f℥ij. . . } B
Tinct. Scillæ f℥ij. . . . } B
Tinct. Camphoræ co. f℥vj. . . . C

Fiat Mist. de qua sumantur Cochl. ij. *ampla tertia quaque hora.*

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125. ℞. Potassæ Nitrat. ℥j.
Mist. Camphoræ f℥v. . . . . P
Aceti Scillæ f℥ss. . . . . B
Spir. Junip. co. f℥iij. . . . . B
Syrup. Zingib. f℥j. . . . . O

Fiat Mistura, de qua sumantur Cochl. ij. *ampla ter quotidie.*

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126. ℞. Potassii Iodidi gr. ij.
Potassæ Bitartrat. ℈j. M. . . . . F

Fiat Pulvis e cyatho aquæ fontanæ bis quotidie sumendus.

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127. ℞. Aceti Scillæ f℥ss.
Spir. Ether. Nitric. f℥j. . . . . B
Decoct. Scoparii comp. . . . . B
et Decoct. Senegæ aa. f℥v. . . . . G

Fiat Haustus, ter de die sumendus.

128. ℞. Potassæ Carbonatis ʒj.
Succ. Limon. fʒſs. vel q. s. } I
Ad saturandum, } *Basis.*

Aquæ fʒj. . . . . P
Spir. Ether. Nitric. fʒj. . . . . B
Fiat Haustus ad urinam movendam.

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129. ℞. Tinct. Cantharidis ♏x — xx.
Spir. Ether. Nitric. fʒj. . . . . B
Mist. Camphoræ fʒx. . . . . P b.
Syrup. Zingib. fʒj. . . . O
Fiat Haustus ter de die sumendus.

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130. ℞. Terebinth. Olei ♏x — xx.
Mellis Despumat. ʒij. . . . P O
Tinct. Scillæ ♏x. . . B
Pulv. Cinnamom. co. q. s. . . P O E
Ut fiat Elect. bis quotidie sumend.

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131. ℞. Junip. Cacumin. ʒij.
Semin. Anisi contus. ʒij. . . G
Aquæ Ferventis Oj. . . . L
Macera per horam, et cola.

℞. Liquoris Colati fʒxij.
Spir. Junip. comp. fʒij. . . . A
Tinct. Scillæ fʒij. . . . B
Potassæ Nitrat. ʒj. . . . B
Syrup Zingib. fʒss. . . . O E
Fiat Mistura, de qua sumat Cyathum subinde, vel quantum sine fastidio, vel nausea, ferri possit.

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132. ℞. Potassæ Bitart. ʒij.
Aquæ Ferventis Oj. L
Limonum Corticis ʒij. . . . . O
Sacch. Alb. q. s. . . . . O
Fiat Solutio pro potu familiari bibend.

133. ℞ Lactis Vaccini ferventis Oj. . . } K
Potassæ Bitart. ʒij. . . . }

Solve—Liquore frigefacto, cola ut separetur serum, huicque adjice saccharum ad libitum, et bibat æger quantum sibi placeat.

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134. ℞. Scillæ Rad. recèns exsiccat. gr. xij.
Potassæ Nitrat. ʒj. . . . B
Pulv. Cinnamom. co. . . . E O
et Sacch. Alb. aa ʒj. . . . O

Fiat Pulvis, in sex partes æquales dividend. e quibus sumatur una bis indies.

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135. ℞. Pil. Scillæ comp. ʒj.
Hydrarg. Chlorid. gr. viij. . . . C

Fiat Massa, in Pilulas xv. *dividenda, e quibus sumantur duæ singulis noctibus.*

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136. ℞. Scillæ Rad. recèns exsiccat. ℈j.
Digitalis Folior. ℈j. . . . F
Hydrarg. Chlorid. gr. v. . . . C
Myrrhæ contritæ ʒfs. . . .
Simul tere, et adde, B } G
Assafœtidæ ʒfs. . . .
Syrup. Zingib. q. s. . . . P O

Ut fiat Massa in Pilulas xx *dividenda, e quibus sumantur duæ nocte maneque.*

The above Formula has been sanctioned by authority, but its propriety may be questioned for reasons already stated (401.)

DIAPHORETICS.

137. ℞. Vini Antimonii Potassio-Tart. ♏xx.
Liquor. Ammon. Acet. fʒfs. . . . B
Mist. Camphoræ fʒj. . . . P f.
Tinct. Opii ♏iij. . . . C

Fiat Haustus, bis quotidie sumend.

138. ℞. Sodæ Carbonatis ℈j. . . . I } *Basis.*
Succ. Limon. f℥ſs. vel. q. s. . . B
Vini Ipecac. f℥ſs. . . . P f.
Mist. Camphoræ f℥j. . . . O
Syrup. f℥ſs. . . . .
Fiat Haustus, ut supra dandus.

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139. ℞. Pulv. Antimonii comp.
Pulv. Ipecac. co. aa ℥ſs. C
Hydrarg. Chlorid. gr. vj. . . . C
Confect. Ros. q. s. . . . . P
Ut fiat Massa in Pilulas xij. *dividenda, e quibus sumantur duæ vel tres, o. n. h. s.*

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140. ℞. Pulv. Antimonii comp. gr. iij. . . H }
Opii contriti gr. j. . . .
Camphoræ gr. iij. . . . L } C
Spir. Rectificat. ♏j. — ij. . . .
Tere simul, ut fiat Massa in Pil. ij. *dividend. quas sumat hora decubitus, et calefacto lecto commissus, superbibat haustum aliquem tepidum, et sudorem expectet.*

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141. ℞. Pulv. Ipecac. gr. iij. . . . H }
Opii contriti gr. j. . . .
Potassæ Nitrat. gr. x. . . .
Tere probe simul, ut fiat pulvis hora decubitus sumendus.

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142. ℞. Infus. Serpentariæ, f℥ix.
Ammoniæ Sesquicarb. gr. v. . . . B
Syrup. f℥j. . . . . O
Fiat Haustus bis de die sumendus.

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143. ℞. Tinct. Guaiac. comp. f℥j.
Mist. Acaciæ f℥j. . . . . P
Tere simul, et adde,
Decoct. Senegæ f℥iſs. . . . . B
Fiat Haustus.

EXPECTORANTS.

144. ℞. Scillæ Rad. recèns exsiccat. ʒfs.
Myrrhæ contritæ ʒfs. . . . . B
Extract. Hyoscyam. ʒij. . . . . G
Liquor Potassæ ℥ij. L
Aquæ q. s. . . . . P

Ut fiat Massa in Pil. xxx. *dividend., e quibus sumantur binæ bis indies.*

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145. ℞. Myrrhæ contritæ gr. vj.
Pulv. Ipecac. gr. iij. . . . . F
Potassæ Nitrat. ʒfs. . . . M P

Misce, et divide in partes quatuor, e quibus sumatur una, quartis horis.

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146. ℞. Scillæ Rad. recèns exsiccat. gr. viij.
Pulv. Ipecac. gr. vj. . . . . F
Camphoræ in pulv. tritæ ʒj. . . . B
Sacch. Alb. ʒj. . . . . M O

Tere in pulverem, et in partes quatuor divide, e quibus sumatur una ter quotidie, superbibendo poculum decocti Hordei.

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147. ℞. Oxymel. Scillæ, ... } B
Syrup. Altheæ, ... }
Mist. Acaciæ, aa fʒfs. . . .

Fiat Linctus, de quo sæpe lambat.

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148. ℞. Mist. Ammoniaci,
et Aquæ Cinnamom. aa. fʒiifs. . . O
Syrup. Tolut. fʒfs. . . . F O
Tinct. Castorei fʒj. . . } B } G
Tinct. Camphoræ comp. fʒiij. . .

Fiat Mist. de qua sumatur Cochl. unum amplum ter quaterve indies.

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149. ℞. Tinct. Scillæ ℥x.
Infus. Serpentariæ fʒix. . . . } B } F
Ammoniæ Sesquicarb. gr. v. . .
Syrup. Zingib. fʒfs. . . . O

Fiat Haustus ad sputum eliminandum.

150. ℞. Mist. Amygdal. f℥j.
Vini Ipecac. ♏xv. . . . . . G
Syrup. Papav. f℥j. . . . . F
Potassæ Bicarb. gr. xv. . . . . K
Fiat Haustus cum cochl. uno amplo Succ. Limon. in impetu ipso effervescentiæ sumendus.

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151. ℞. Acid. Benzoic. gr. iij.
Myrrhæ contritæ gr. v. . . . . B
Scillæ Rad. recèns exsiccat. gr. j. . . . F
Pulv. Trag. comp. gr. v. . . . . P
Fiat Pulvis ex melle sumendus.

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152. ℞. Ammoniaci ℥j.
Acid. Nitric Dilut. f℥j. . . . . L C
Aquæ f℥iij. . . . . P
Tere simul, secundum artem, donec emulsio fiat, et deinde adde
Syrup. f℥ij. . . . . O
Sumatur Cochl. unum mediocre, ex liquore aliquo mulcente.

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153. ℞. Tinct. Scillæ ♏viij.
Acid. Nitric. Dilut. ♏vj. C
Extract. Hyoscyami gr. v. . . . B } G
Syrup. Papaveris f℥j. . . . . }
Aquæ f℥iſs. . . . . P
Fiat Haustus, bis terve indies sumendus.

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154. ℞. Pyrethri Rad. contrit.
Mastiches aa ℥j. . . . . P
Fiant, lege artis, ad ignem masticatoria duo; et uno vel altero menducat. exspuat salivam.

Constitutional Sialogogues will be found under the head of Alteratives.

REFRIGERANTS.

155. ℞. Potassæ Nitrat. ʒj.
Fiat Pulvis, e cyatho aquæ perfrigidæ prompte hauriendus.

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156. ℞. Acid. Hydrochloric. Dilut. fʒſs.
Decoct. Hordei Oj. . . . . P
Mellis Despumat. ʒſs. . . . . O
Sumatur quotidie, quasi potus familiaris.

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157. ℞. Sodæ Sesquicarb. ʒj.
Aquæ fʒj. L
Syrup. fʒſs. . . . . O
Fiat Haustus cum Cochl. uno amplo Succi Limonum recentis (K) *in imp ipso effervescentiæ subinde sumendus, ad sitim in febribus cohibendam.*

Quædam Extrinsecus admovenda.

158. ℞. Ammoniæ Hydrochlorat. ʒij.
Aceti Destillati fʒij. . . . L F
Spir. Camphoræ fʒſs. . . . F
Fiat Lotio.

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159. ℞. Liquor. Plumbi Diacetat. fʒj.
Aceti Destillati fʒij. . . L
Spir. Tenuior. fʒſs. F
Aquæ Destillat. fʒiij P
Fiat Lotio.

ANTACIDS.

160. ℞. Liquor Potassæ fʒij.
Liquor. Calcis fʒij. . . . . G
Misce, et capiat æger, acido infestante, Coch. unum amplius alterumve, e poculo jusculi bovini.

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161. ℞. Magnesiæ Carb. ʒiſs.
Ammoniæ Sesquicarb ʒſs. . . . . B
Aquæ Menthæ viridis fʒvſs. . . .
Tinct. Lavandulæ comp. fʒij. . . . B G
Spir. Carui fʒj. . . .
Syrup. Zingib. fʒij. . . .
Fiat Mist. de qua sumatur Cochl. unum amplius, p. r. n.

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162. ℞. Ammoniæ Sesquicarb. gr. v.
Extract. Rhei gr. viij. . G
Syrup. Zingib. q. s. . . . P
Ut fiat massa in Pil. tres dividend. et p. r. n. sumend.

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163. ℞. Magnesiæ Carbonatis gr. x.
Sodæ Sesquicarb. gr. xv. . . B
Zingib. Contrit. gr. v. . . . G
Glycyrrhizæ contrit. gr. v. . . P
Misce, ut fiat Pulvis familiaris, adversus ventriculi acorem sumendus.

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164. ℞. Potassæ Bicarbonat. ϑj.
Potassæ Nitrat. gr. v. . G
Misce, et fiat Pulvis hor. ij. *post Prand. sumend.*

ANTILITHICS, AND LITHONTHRYPTICS.

A. In the Lithic Acid Diathesis.

165. ℞. Potassæ Bicarbonat. ʒj.
Infus. Quassiæ fʒix. . . . G } G
Tinct. Humuli fʒi. . . }
Syrup. Zingib. fʒj. . . . . O
Fiat Haustus ter quotidie sumendus.

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166. ℞. Liquor Potassæ ♏xv.
Infus. Serpentariæ fʒix. . . A { G E
Tinct. Serpentariæ fʒj. . . }
Syrup. Zingib. fʒfs. . . . O
Fiat Haustus, bis quotidie sumend.

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167. ℞. Magnesiæ ʒfs.
Camphoræ contritæ gr. v. . . . . G
Syrup. Ros. fʒij. . . . . O
Tere simul, et gradatim adde,
Aquæ fʒvfs.
Tinct. Hyoscyam. fʒij. . . . G
Fiat Mist. de qua sumatur Cochl. ij. *ampla quartis vel sextis horis.*

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168. ℞. Potassæ Bicarb. ʒij.
Infus. Anthemid. fʒx. . . . . P E
Tinct. Opii ♏v. . . . . G
Syrup. fʒj. . . . . O
Fiat Haustus sextis horis sumendus, et ad tertiam vel quartam vicem repetendus; deinde, nisi per se alvus dejecerit, sumatur medicamentum quod de Formula 98 *preceptum est; eademque alternatem fiant per mensem.*

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169. ℞. Liquor Potassæ ♏xx.
*Sumatur e jusculo, aut cerevisia tenuiori, bis quotidie.**

* Dr. Chittick's once celebrated nostrum for the stone consisted of a fixed alkali in veal broth; the broth was usually made by his patients, and sent to him fresh every day to be medicated. A. D. 1766.

170. ℞. Acid. Benzoic. gr. ij.
Sodæ Biphosphatis gr. viij. . . . . **L**
Tere simul, et adde
Aquæ Destillatæ fʒix. . . . . **P**
Fiat Haustus, ter quotidie sumendus.

Aliud ad eundem Scopum.

171. ℞. Acid Benzoic. gr. ij.
Sodæ Biboratis gr. iv. . . . . **L**
Tere simul cum
Aquæ Destillat. fʒix. . . . . **P**
Fiat Haustus.

LITHAGOGUES.

172. ℞. Olei Terebinth. ℥xx.
Mist. Acaciæ fʒſs. . . . . **M**
Tere simul, et adde,
Aquæ fʒj. . . . . **P**
Tinct. Opii ℥x. . . . . **G**
Fiat Haustus, bis indies sumend.

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173. ℞. Vini Colchici fʒſs.
Mist. Camphoræ fʒix. . . . . **P**
Liquor Potassæ ℥x. . . . . **C**
Syrup Aurantii fʒj. . . . . **O**
Fiat Haustus, sextis horis sumendus, catharsi rite præmisso.

B. In the Phosphatic Diathesis.

174. ℞. Acid Hydrochloric. Dilut. fʒſs.
Decoct. Hordei comp. fʒiſs. . . . **P**
Fiat Haustus bis quotidie sumendus.

175. ℞. Pareiræ ʒv.
Aquæ Destillat. Oiij.
Coque ad Oj., *et cola,*
℞. Colaturæ fʒij.
Extract. Pareiræ gr. x. . . . . **A**
Acid. Nitric. Dilut. fʒſs. . . . . **G**
Syrup. fʒj.
Fiat Haustus.
Hæc supra præscripta in mensem unum aut alterum continuare oportebit.

ANTHELMINTICS.

176. ℞. Stanni Limat. ʒj.
Sacchari Fæcis fʒij. . . . . **P**
Fiat Electuarium, bis quotidie sumend. et per dies tres repetend. postea, purgetur alvus.

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177. ℞. Cambogiæ gr. viij.
Hydrarg. Chlorid. gr. v. . . . . **F**
Saponis q. s. . . . . **P**
Ut fiant Pilulæ tres, jejuno ventriculo contra Tæniam capiendæ; et horis quatuor elapsis, exhibeatur Haustus purgans.

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178. ℞. Ferri Sesquioxidi ϑj.
Sodii Chlorid. gr. xv. . . . . **F**
Confect. Ros. q. s.
Ut fiat Electuarium, hora ante jentaculum, diebus a purgatione liberis, sumendum.

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179. ℞. Ol. Terebinth. fʒj.
Sumatur e cyatho aquæ, cui adjiciatur.
Tinct. Aurantii fʒij. . . . . **O**

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180. ℞. Camphoræ contritæ ϑj.
Olei Olivæ fʒij. . . . . **M**
Tere simul, et adde,
Decoct. Hordei fʒij. . . . . **P**
Fiat Enema, contra Ascarides.

181. ℞. Aloës contritæ gr. x.
Saponis ʒj. . . . . **P** l.
Fiat Suppositorium, oleo illitum, et post alvum exoneratam ano immittendum.

DEMULCENTS.

182. ℞. Cetacei.
Pulv. Trag. comp. aa ʒfs. . . . **B**
Syrup. Papav. q. s.
Optime misceantur, et fiat Linctus; quem per vices lambat, et ore teneat æger, ut sensim liquescens deglutiatur.

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183. ℞. Cetacei ʒj.
Vitelli Ovi dimid. . . . . **M**
Syrup. Papav. fʒij. . . . . **G**
Aquæ Cinnamom. fʒij. . . . **O**
Aquæ Destillat. fʒiij. . . .
Fiat Mistura, de qua subinde capiat æger Cochl. unum amplius.

ALTERATIVES.

184. ℞. Pil. Hydrarg. Chlorid. comp. gr. v.
Fiat Pilula o. n. sumenda.

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185. ℞. Decoct. Sarzæ comp. fʒij.
Syrup. Sarzæ fʒj. . . . . **A**
Extract. ejusdem ℈j. . . . . **A**
Fiat Haustus bis quotidie per mensem, ad minimum, sumend.

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186. ℞. Decoct. Sarzæ comp. fʒij.
Liquor Hydrarg. Bichlorid. fʒfs.—fʒj. . . **G**
Fiat Haustus bis quotidie sumendus.

187. ℞. Hydrarg. cum creta gr. v.
Pulv. Ipecac. comp. gr. ij. . . . G C
Fiat Pulvis sextis horis sumendus.

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188. ℞. Ung. Iodini comp. ℥j.
Infricetur tumori ad magnitudinem Fabæ, o. n.

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189. ℞. Liquor. Iodid. Potass. comp. f℥j.
Mist. Camphoræ f℥j. . . . P E
Fiat Haustus, bis quotidie sumend.

THE END.

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